CFTRI-MYSORE
1114
Manual for food

Acc. No. 1114

1. water
2. carbohydrates
3. fats
4. fruits
5. vegetables
6. proteins
7. batters
8. doughs
9. food preservation.

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MANUAL FOR FOOD PREPARATION STUDY

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MANUAL
FOR
FOOD PREPARATION STUDY

BY

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IN THE REPRINTING OF THIS BOOK, THE RECOMMENDATIONS OF THE WAR PRODUCTION BOARD HAVE BEEN OBSERVED FOR THE CONSERVATION OF PAPER AND OTHER IMPORTANT WAR MATERIALS. THE CONTENT REMAINS COMPLETE AND UNABRIDGED.

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Manual for food

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PREFACE

A course in food preparation in the curriculum of a school of higher education is justified when the study is approached as a science. It then offers an opportunity to develop the student an attitude of inquiry, of keen observation, and of intellectual honesty ualities which are an essential part of a student's equipment for her work either during ool or in after years. It should not be part of a college course to train a student to be accomplished cook. Rather should it be the college function to teach the theory and nciples which underlie the everyday practical uses of food and food combinations.

To meet the needs from this point of view, an attempt has been made in this volume ssemble and develop experimental studies of the different foodstuffs and foods, so that r composition and physical and chemical properties may be known and their reactions icipated before they are combined into the complex systems known as recipes, the elopment of which makes up so many courses in food preparation.

With the knowledge gained from the experimental studies and the development of ndards of food, the student should be able to develop her own methods of combining l and understand or criticize the recommended methods. With a little intelligent ctice in her own home and that required in her future foods courses, she should become mpetent in a reasonable length of time to prepare a standard food product or to super- the preparation.

To arouse her imagination and to stimulate her enthusiasm for the handling of food terials in a practical way the student should have a background knowledge of foods their functions—should know something of their origin and their place in the economic tory of nations, their many forms and functions among the different peoples of the ld. She should understand the processing of foods, and she should know how to select nutritive values, as well as for cost. The authors appreciate their extreme good fortune hat several books on the subject matter of the manual have recently been published, king the necessary supplementary material conveniently available.

As a prerequisite to the physical-chemical study of foods, college physics and at least year of chemistry are essential. If organic chemistry cannot be studied before entering food preparation course, it should at least parallel the study of foods.

The experimental studies in the present manual and the practical application of the nciples gained from the studies require one semester of three two-hour laboratory ods a week. In addition, two one-hour discussion periods are necessary for the supple- ntary information. It is possible that not all the experiments can be used in some courses re the time for food preparation is short, but a discriminating selection may be made hose which will meet the local situation to the best advantage. It is not recommended t practical applications at the end of each set of experiments be omitted as a means

of shortening the course. The authors feel that the tie-up between the ideas developed by the experiments must be made by their interpretation in practical procedure.

The manual has been constructed to do away with notebook work, which is so often trying to both student and teacher. There are spaces for the student to record observations, and a brief summary of the fundamental principles may be made on a sheet of notebook paper at the end of the experiment and inserted in the proper place.

The authors hope that this volume, which has been evolved from many years' experience in teaching the subject, will fill a need for a manual for food preparation study in universities, colleges, and normal schools. The senior author acknowledges with appreciation the helpful interest, suggestions and enthusiasm of Dr. P. Mabel Nelson and the food preparation staff at Iowa State College. She is also indebted to Dr. Agnes Fay Morgan,of the University of California, and to Dr. Mabel T. Wellman, formerly of Indiana University, for the stimulus derived from her associations with them.

The junior author wishes to express her deep appreciation to Dean Marie Mount and Mrs. Claribel Welsh for their helpful encouragement and cooperation. Special thanks are due her co-workers on the foods staff for their helpful criticisms and suggestions.

F. B. K.
M. E. K.

June, 1941

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INTRODUCTION

Abbreviations

t.	teaspoon	gm.	gram
tb.	tablespoon	oz.	ounce
c.	cup	lb.	pound
pt.	pint	ml.	milliliter
qt.	quart	min.	minute

I. Become familiar with:
   1. Desks—names, arrangement and care of equipment.
   2. Structure and method of lighting stove burners.
   3. Method of lighting ovens and broilers.
   4. Use of oven regulators and oven thermometers.

II. Methods used in measuring.
Demonstrated by instructor then applied by members of class.

Measures	Individual results	Standard
1. ? t. = 1 tb.		
2. ? tb. = 1 c. (dry measure)		
3. ? tb. = 1 c. (liquid measure)		
4. ? c. = 1 pt.		
5. ? pt. = 1 qt.		
6. ? ml. = 1 c.		

III. Use of spring and trip balances.

Weights	Individual results	Standard
1. ? gm. = 1 oz.		
2. ? oz. = 1 lb.		
3. ? gm. = 1 lb.		

IV. Use of thermometer.
Explanation of Centigrade and Fahrenheit scale.
Record in Centigrade and change to Fahrenheit.

Temperature of	Degrees C.	Degrees F.
1. Laboratory		
2. Cold water		
3. Hot water		

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 155–156.
MACLEOD, A. L., and NASON, E. N. *Chemistry and Cookery*. Second Edition. pp. 224–228.
SHELDON, H. H., KENT, C. V., PATON, R. F., and MILLER, C. W. *Physics for Colleges*. Second Edition. pp. 149–153.

MANUAL FOR FOOD PREPARATION STUDY

WATER

Water is a constituent of all foods. The amount varies from the driest foods, containing less than one per cent, to certain fruits and vegetables which contain over 95 per cent. Water may exist as a solid, a liquid, or a gas. Energy is involved in the transformation from one form to another.

For cookery purposes, water may be called:

Hard—containing mineral salts.

a. Permanent—containing sulfates of calcium, magnesium, or of other minerals.
b. Temporary—containing bicarbonates of calcium, magnesium, or of other minerals.

Soft—containing no mineral salts but possibly organic matter.

Softened—mineral salts rendered insoluble in some manner.

Distilled—free from mineral salts and organic matter.

Water is used in cookery for:

A medium for applying heat.

A solvent.

Hydration of foods.

A dispersion medium.

A. *Changes in the physical appearances of water as it is brought to the boiling point, and its temperature at various stages in heating.*

1. Place a 400 ml. beaker, half full of cold water, on a wire mat over a low flame. Suspend a thermometer so that the bulb is completely covered by water yet not touching the beaker. Bring water *slowly* to the boiling point. Observe temperatures, record in Centigrade, change to Fahrenheit, and compare with standard. The thermometer should be held perpendicular and should not touch the beaker. The eye should be on a level with the part of the scale being read.

Observe temperature and compare with standard	C.	F.	Standard
a. Cold water as drawn from the tap without heating			
b. When small bubbles appear on the sides and bottom of the beaker			
c. When water feels neither warm nor cold to the hand (lukewarm)			
d. When large bubbles appear at bottom and edge of water (scalding)			
e. When bubbles rise and break before they reach the surface (simmering)			
f. When bubbles rise and break at the surface (boiling)			
g. When water boils very rapidly			
h. Record the boiling point of your thermometer			

What are the bubbles in

b. _____

f. _____

Describe the appearance of the water when the flame is low and the mercury is at its highest point.

_____

_____

1. What is the boiling temperature of water in centigrade degrees at sea level? In Fahrenheit degrees?
2. What is the altitude here?
3. What would be the boiling temperature in a community 9,000 feet above sea level?
4. One thousand feet below sea level?
5. For practical cooking purposes, is there any difference between the temperature of food cooked in rapidly or slowly boiling water?
6. If a vacuum evaporator is used, is the boiling temperature increased or reduced?
7. Define boiling, simmering, and scalding.
8. How much energy does it take to change 1 gm. of water to steam?
9. What happens to the energy when steam condenses?
10. Why is a steam burn more severe than one caused by boiling water?

REFERENCES

LOWE, B. *Experimental Cookery*. Second Edition. pp. 46–49.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 58–62.
SHELDON, H. H., KENT, C. V., PATON, R. F., and MILLER, C. W. *Physics for Colleges*. pp. 179–182.
SWEETMAN, M. D. *Food Preparation*. Second Edition. pp. 49–61.

B. *Conditions affecting evaporation.*

Measure 100 ml. of water into each of four 250-ml. beakers and one large shallow saucepan. Treat as follows:

1. Boil rapidly for 3 min. Cool to 65°C., then measure the amount left.
2. Bring to a boil quickly, then maintain the water at the boiling point for 3 min. with the smallest amount of heat possible. Cool to 65°C. Measure the amount left.
3. Heat to 85°C., and maintain at that temperature (simmering) for 3 min. Cool to 65°C. Measure the amount left.
4. Cover beaker and boil rapidly for 3 min. Keep cover on, cool to 65°C., then measure the amount left.
5. Using large shallow saucepan boil rapidly for 3 min. Cool to 65°C., then measure the amount left.

CONDITIONS AFFECTING EVAPORATION

Experiment	Amount water left		Per cent loss	
	Individual	Class range	Individual	Class range
1. Boiled rapidly				
2. Boiled slowly				
3. Simmered				
4. Boiled covered				
5. Boiled in shallow pan				

Formulate the laws of evaporation.

State conditions for maximum evaporation in cooking.

C. *Conditions affecting palatability of water.*

Boil 1 c. of tap water rapidly for 5 min. Divide into two portions. Allow one (a) to cool. Pour the other (b) back and forth into another utensil through the air several times and allow to cool. Taste each, then reheat them and notice the temperature of each at which the first bubbles form. Compare with formation in Exp. A.

RESULTS OF BOILING WATER

Experiment	Flavor	Temperature of bubble formation
Cooled		
Aerated		

1. Is there a precipitate in the boiled water?
2. What is it?
3. What changes have taken place in the water due to boiling?
4. Why is it important that the water be brought just to the boiling point in making tea or drip coffee?

D. *Temperatures obtained in cooking operations.*

1. Double boiler. Place 1 c. of water in the inner part of a double boiler. Record the temperature when the water in the outer part is (a) simmering, (b) after it has boiled 10 min., (c) 20 min.
   (a) _____
   (b) _____
   (c) _____
2. Steamer. Record the temperature in the upper part of a steamer with (a) lid on, (b) lid off, when the water is boiling. Use a maximum thermometer or suspend a thermometer through a cork in the lid of the steamer.
   (a) _____
   (b) _____
3. Pressure cooker. Observe the parts of the cooker. The temperature increases within the cooker, as the pressure gage shows increased steam pressure within the cooker.

Pressure after 7 min. steam outlet:	Temperature at sea level to 2,000 feet:
5 lb.	109°C.
10 lb.	115°C.
15 lb.	121°C.
20 lb.	125°C.
25 lb.	131°C.

4. Pressure saucepan. Observe the parts of the pressure saucepan. Place ½ c. water in the pan. Seal the pan and heat rapidly. Record (a) time required to cause a full flow of steam. Cover the outlet. Record (b) time required to bring to 15 lb. pressure. Remove from fire and set in cold water. Record (c) time required to bring the indicator to zero.
   (a) _____
   (b) _____
   (c) _____

5. Oven. Record the temperature of a thermometer suspended in a utensil containing 1 qt. cold water when the oven temperature is (a) 121°C. (250°F.), (b) 163°C. (325°F.), (c) 205°C. (400°F.), (d) 232°C. (450°F.). Record also the time required to reach each temperature.

Experiment	121°C.	163°C.	205°C.	232°C.
Temperature of water				
Time required				

1. Could conditions be created in which the water in the top part of the double boiler would boil?
2. Would the addition of salt to the boiling water in the steamer raise the temperature of the steam?
3. What are the relative temperatures obtained in the double boiler, steamer, and pressure cooker?
4. Compare the heating and cooling times required for a pressure cooker with those required for a pressure saucepan.
5. Would a steak heat more rapidly in the broiler than in the oven?
6. Explain the transfer of heat by convection, conduction, radiation.
7. Name good and poor conductors of heat.

REFERENCES

MacLeod, A. L., and Nason, E. H. *Chemistry and Cookery*. Second Edition. pp. 67–72.
Sheldon, H. H., Kent, C. V., Paton, R. F., and Miller, C. W. *Physics for Colleges*. Second Edition. pp. 208–212.
Sweetman, M. D. *Food Preparation*. Second Edition. pp. 56–60.

BEVERAGES

A beverage is a drink, usually made with water acting as the solvent. The solutes may form both true and colloidal solutions. Solutes may be removed from a substance by:

Decoction—in which a liquid boils in contact with the substance from which the solutes are to be removed.

Infusion—in which the substance from which the solutes are to be removed is soaked or steeped in hot water.

Percolation—in which a boiling liquid percolates through the substance until the solutes are removed.

Filtration or drip—in which a hot liquid moves slowly over the exposed surface of the substance until the solutes are removed.

Mixing—in which, usually, cold water is mixed with the material containing solutes, which remain in the beverage.

TEA

Tea is prepared from the leaves and leaf buds of the tea shrub, which is grown in the Orient. The tea is classified for market according to the position of the leaf on the stem and according to the degree of fermentation.

Position of leaf on stem:

Green tea	*Black tea*
Gunpowder	Flowery pekoe
Imperial	Orange pekoe
Young Hyson	Pekoe
Hyson	Soochong

The choicest teas are the buds and young leaves; the lower on the stem the leaves are obtained, the less their value. Green tea is not fermented in preparation for market; black tea is fermented, and oolong tea is semi-fermented. The fermentation changes the color, flavor, and the solubility of the tannin compounds. Most tea as purchased is a blend of teas from different sources.

The soluble constituents which may be obtained by infusion of tea are:

1. Caffeine, alkaloid—stimulant.
2. Tannin compounds—astringent.
3. Theol, volatile oil—flavor.
4. Colored substances—color.

A. *Water as a solvent in the preparation of tea.*

1. Black tea. Measure 1 gm. in teaspoonfuls. Use 1 gm. tea for each experiment. Treat in manner indicated for each. Strain into a beaker.
   a. Add 1 c. water which has been heated to 85°C. Let steep for 3 min.
   b. Repeat a, using freshly boiling water.
   c. Add 1 c. boiling water and let boil 5 min. Replace water lost by evaporation.
   d. Add 1 c. boiling water. Let steep 20 min.
   e. Dip a teaball containing 1 gm. tea into 1 c. boiling water for ½ min.
2. Green tea. Repeat b.
3. Oolong tea. Repeat b.
   Compare products for flavor, color, and strength. Record results.
4. Tannin test. Put 10 ml. tea infusion from each experiment into a test tube; add 15 drops cupric acetate solution (1 gm. to 50 ml. water). Boil. Set aside for 24 hours. Compare.

TEA EXPERIMENT

Experiment	Flavor	Color	Strength	Tannin
1. *Black tea* a. Water at 85°C., steeped 3 min.				
b. Boiling water, steeped 3 min.				
c. Boiling water, boiled 5 min.				
d. Boiling water, steeped 20 min.				
e. Boiling water, steeped ½ min.				
2. *Green tea* f. Boiling water, steeped 3 min.				
3. *Oolong tea* g. Boiling water, steeped 3 min.				

Formulate a satisfactory method for preparing tea.

Prepare various grades of black, green, and oolong tea.

STANDARD PRODUCT

Type tea	Appearance	Flavor	Body
Black			
Green			
Oolong			

1. Which contains more tannin, a green or black tea infusion?
2. Why is there a difference in the color and flavor of tea infusion from green and black tea?
3. What conditions are favorable for extraction of tannin?
4. Is it desirable to have some tannin present in tea? Explain.
5. What causes some iced tea to become cloudy?
6. Why does the use of lemon in tea make it lighter in color?
7. What would be the effect on the flavor of the tea infusion if large amounts were purchased and tea was rarely served?
8. How should tea be kept in the home to retain maximum flavor?

COFFEE

Coffee is obtained from the berry of an evergreen tree grown in the tropical climates. The seeds are harvested and prepared for shipping to the various world markets, where they are blended and roasted. The roasting process is extremely important, as the substances produced and lost in roasting control the color and the flavor of the coffee brew. The soluble constituents which may be obtained in brewing are:

1. Caffeine, alkaloid—stimulant.
2. Caffetannic acid—astringent.
3. Caffeol, volatile oil—flavor.
4. Caramel and colored substances—color.

A. *Water as a solvent in the preparation of coffee.*

1. Coffee. Weigh out 10 gm. coffee (a) finely ground, (b) medium ground, (c) coarsely ground. Measure it in tablespoonfuls.
   (a) _____
   (b) _____
   (c) _____
   a. Mix 5 gm. coarsely ground coffee with 1 tb. water and ½ t. egg white; put into a scalded coffee pot. Add 1 c. boiling water. Bring to a full boil. Let steep for 5 min. Decant into a beaker.
   b. Repeat, omitting the egg.
   c. Tie 5 gm. coarsely ground coffee *loosely* in cheesecloth; put into scalded coffee pot. Add 1 c. boiling water. Bring to boiling temperature. Let steep for 5 min. Pour into a beaker.

d. Place 10 gm. medium-ground coffee into the coffee basket of a percolator. Pour 2 c. water into the percolator and percolate 7 min. after the water has begun to bubble over the coffee. Allow to stand a few minutes. Pour into a beaker.
e. Place 5 gm. finely ground coffee in basket of dripolator. Pour on it 1 c. boiling water and let stand in hot place. Pour into a beaker.

Compare products for color, clearness, strength, and flavor. Record results.

COFFEE EXPERIMENT

Experiment	Color	Clearness	Strength	Flavor
a. Steeped with egg				
b. Steeped without egg				
c. Steeped in bag				
d. Percolated				
e. Dripped				

2. Using a satisfactory method for preparation, make coffee brews from different brands and grades of coffee and decaffeinated coffee. Prepare soluble coffee and coffee substitute according to directions on the can. Compare brews for color, strength, and flavor.

STANDARD PRODUCT

Type	Appearance	Flavor	Body
Steeped			
Percolated			
Dripped			

1. Give conditions necessary for maximum amount of caffeol in a coffee brew. For tannin. For caffeine.
2. Which method of preparation of coffee gives maximum caffeol and minimum tannin?
3. What are two effects of the use of egg in making "boiled" coffee?
4. Why does the addition of cold water "settle" coffee?
5. Which is the most economical coffee granulation to use?
6. What is the effect of the use of a metal coffee pot on the flavor of the coffee brew?
7. Why does boiling coffee reduce the caffeol flavor?
8. How should coffee be kept in the home?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 18–24.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 112–116, 118–121, 459–462.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. Chap. XLIII.
MORGAN, A. F., and HALL, I. S. *Experimental Food Study*. Chap. V.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XXIV.
WILMOT, J. S., and BATJER, M. Q. *Food for the Family*. pp. 332–342.

SOLUTIONS

A. *The effect of substances on the boiling point of water.*

1. Salt. Heat ½ c. of water in a 250-ml. beaker. When boiling add 1 t. salt, boil, and note temperature. Continue adding the salt by teaspoonfuls as long as the boiling point is affected. Place a mark at original surface of the water on the outside of the beaker, and see that the total volume of liquid remains at the same level throughout the experiment by adding boiling water as needed.
2. Sugar. Repeat, using sugar as the dissolved substance and adding 1 tb. at a time.
3. Gelatin. Repeat, using gelatin which has previously been mixed with an equal amount of cold water. Use 1 t. gelatin for each addition. Two additions are sufficient.
4. Sawdust. Repeat, using sawdust. Two additions are sufficient. Notice the movement of the sawdust in the water.

ELEVATION OF BOILING POINT BY SUBSTANCES

Experiment	Amount substance used									
	1 t.	2 t.	3 t.	4 t.	5 t.	6 t.	7 t.	8 t.	9 t.	10 t.
1. Salt										
			1 tb.			2 tb.			3 tb.	4 tb.
2. Sugar										
3. Gelatin										
4. Sawdust										

1. What is the difference in the size of the particles used in 1, 2, 3, 4?
2. Which will have the largest number of particles in equivalent measures? The fewest?
3. Considering their ionization, would calcium chloride raise the boiling point of water more or less than sodium chloride? Explain.
4. What causes the variation in the effect of dissolved substances on the boiling point of solutions?
5. Define a solution; a saturated solution; a supersaturated solution.
6. What are the differences in a true solution, a colloidal dispersion, and a suspension.
7. How does an ionic solution differ from a molecular solution?

REFERENCES

LOWE, B. *Experimental Cookery*. Second Edition. pp. 2–4, 44–49.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 73–77, 82–91, 194–199.
SHELDON, H. H., KENT, C. V., PATON, R. F., and MILLER, C. W. *Physics for Colleges*. pp. 179–183.
SWEETMAN, M. D. *Food Preparation*. pp. 58–60, 73–87.

B. *Temperatures of freezing mixtures.*

Mix together pulverized ice and salt in the following proportions:

1. One part ice to one part salt (100 gm. to 100 gm.).
2. Ten parts ice to one part salt (150 gm. to 15 gm.).
3. Pulverize ice alone.

Record the temperature of each (a) when lowest temperature obtainable is reached after mixture is made, (b) when all of the ice is melted. (c) Note the length of time required in each case before the ice is melted.

TEMPERATURE OF FREEZING MIXTURES

Experiment	Lowest temperature reached	Temperature when all ice is melted	Length of melting time
1. Equal parts ice and salt			
2. 10 parts ice to 1 part salt			
3. Ice alone			

1. How much energy is absorbed in the change of 1 gm. of ice to water?
2. What is the effect of the proportion of salt to ice on the rapidity of melting the ice; on the temperature obtained?
3. What would be the effect of the freezing of a tub of water in a cellar on the temperature of the room?

C. *The effect of substances on the freezing temperature of water.*

1. Prepare 5 labeled test tubes and place each of the following solutions in a tube:
   a. 10 ml. distilled water.
   b. 10 ml. 10% salt solution.
   c. 10 ml. 25% sugar solution (unheated).
   d. 10 ml. 25% sugar solution (boiled and cooled).
   e. 10 ml. 3% gelatin solution.

   Mark the level on the outside of each tube after thermometer is inserted.
   Freeze in a 1 to 1 mixture of ice and salt.
2. Repeat 1, using a freezing mixture of 10 to 1.
   Record the freezing point, time required to freeze, the relative increase in volume.
   Compare the textures of c and d.

a. Place 10 ml. distilled water in test tube. Place in ice. Does it freeze? Explain.

EFFECT OF SUBSTANCES ON FREEZING TEMPERATURES

Freezing mixture 1 to 1				Freezing mixture 10 to 1			
Experiment	Freezing temperature	Time	Relative volume increase	Experiment	Freezing temperature	Time	Relative volume increase
a. Distilled water				Distilled water			
b. Salt				Salt			
c. Sugar (unheated)				Sugar (unheated)			
d. Sugar (boiled)				Sugar (boiled)			
e. Gelatin				Gelatin			

1. What is the effect of a true solution on the freezing temperature of water? Of a colloidal solution?
2. Can you make an ice so sweet that it will not freeze with an ice and salt mixture?
3. Why does the volume increase when the solutions are frozen?
4. To obtain a finer-textured ice, would you boil a sugar solution? Explain.
5. Will the stirring with the thermometer of the mixture in the test tube as it freezes make a difference in the texture?
6. To obtain a coarse-textured ice, would a large or small proportion of salt to ice be used?
7. Define a freezing mixture.
8. Explain the structure of an ice cream freezer.

FROZEN DESSERTS

An ice is a frozen, diluted, and sweetened fruit juice, stirred while freezing.

A frappe is an ice frozen to a mushy consistency.

A sherbet is an ice to which has been added some colloidal substance, such as milk, egg white, or gelatin which decreases the size of the crystals and produces a smoother texture.

An ice cream is frozen, flavored, and sweetened light cream (plain or American). Custard ice cream is plain ice cream mixture with eggs added and frozen (French).

A mousse is a sweetened, flavored, whipped-cream mixture which may contain gelatin or other binding material, frozen without stirring.

Prepare frozen desserts.

STANDARD PRODUCT

Product	Appearance	Texture	Flavor
Ice			
Frappe			
Sherbets			
Ice creams			
Mousse			

1. Distinguish between an ice and a frappe; an ice and a sherbet.
2. What would be the effect on the texture of an ice if the dasher was left out of the freezer?
3. What is the overrun in frozen desserts? What causes it?
4. Explain how the following affect the size of crystals in frozen mixtures:
   a. Thoroughness of solution.
   b. Interfering substances.
   c. Homogenization.
   d. Rapidity of freezing.

5. If an ice has a freezing temperature of −4 to −5°C., and an ice cream a freezing temperature of −1 to −2°C., which will feel colder and which will melt faster?
6. Why do ices have a lower freezing temperature than ice cream?
7. Does the high fat content of ice cream affect the freezing temperature?
8. Explain why the texture of ice cream is finer than that of an ice.
9. Why is the fruit juice added to the milk when both are cold?
10. Explain why a mousse can be frozen without stirring.

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. Chap. IX.
HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. IX.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 273–279.
LOWE, B. *Experimental Cookery*. Second Edition. Chap. III.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 77–79, 87–88.
MORGAN, A. F., and HALL, I. S. *Experimental Food Study*. Chap. V.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XI.
SWEETMAN, M. D. *Food Preparation*. Second Edition. Chap. XII.

CARBOHYDRATES

Carbohydrates are foodstuffs formed mostly in plants which are capable of synthesizing them from carbon dioxide and water. The three major classes found in foods are:

Monosaccharides—$C_6H_{12}O_6$.
- Glucose, dextrose, grape sugar, starch sugar.
- Fructose, levulose, fruit sugar.
- Galactose.

Disaccharides—$C_{12}H_{22}O_{11}$.
- Sucrose.
- Lactose.
- Maltose.

Polysaccharides—$(C_6H_{10}O_5)_n$.
- Starch.
- Dextrins.
- Cellulose.
- Inulin.

The mono- and disaccharides are called sugars and are characterized by their sweet taste and crystalline form.

The polysaccharides are rather tasteless and non-crystalline in form.

The polysaccharides and disaccharides are anhydrides of the monosaccharides and have the following relationships:

Cellulose ——————————————→ dextrose.
Starch ——→ dextrins ——→ maltose ——→ dextrose.
Sucrose ——→ dextrose and levulose.
Lactose ——→ dextrose and galactose.
Inulin ——————————————→ levulose.
Galactan ——————————————→ galactose.

REFERENCES

JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 23–24, 250–262.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 31–33.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 305–308.
SWEETMAN, M. D. *Food Preparation*. Second Edition. p. 4.

SUGAR

A. *Composition and physical properties of food materials high in sugar.*

Food material	Per cent carbohydrate	Form	Color	Flavor	Source
Dextrose	100				
Levulose	100				
Lactose	100				
Maltose	100				
Sucrose					
Granulated sugar	100				
Block sugar	100				
Powdered sugar	100				
Confectioners sugar	97				
Candy (hard)*	99				
Brown sugar*	95.5				
Maple sugar*	90				
Honey (strained)*	79.5				
Corn sirup*	74				
Sorghum sirup*	67				
Cane sirup*	67				
Jellies*	65				
Maple sirup*	64				
Cane molasses (medium)*	60				

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials.* U.S.D.A. Circular No. 549.

B. *The comparative sweetness of sugars.*

Taste samples of sucrose, maltose, lactose, levulose, and dextrose. Rank in descending value or sweetness.

Relative Sweetness of Sugars

1. _____
2. _____
3. _____
4. _____
5. _____

C. *The solubility of sugar.*

1. Place 1 tb. of granulated sugar (sucrose) in each of two beakers. Pour ½ c. of cold water on one (a) and ½ c. of boiling water on the other (b). Stir each and record the time necessary for each to dissolve.

Experiment	Time
a. Cold water	
b. Hot water	

D. *A test for the presence of a reducing sugar, the hydrolysis of a disaccharide.*
To make a test with Fehling's solution, use equal amounts of cupric sulfate solution (solution A) and alkaline tartrate solution (solution B).

1. Put 1 ml. of Fehling's solution in a test tube. Add 4 ml. water and boil. Notice color. Reserve for comparison with later tests.
2. Put 1 ml. of Fehling's solution in a test tube. Add 4 ml. water and boil. Add dilute dextrose solution a few drops at a time and heat after each addition. Brownish-red cuprous oxide indicates the presence of a reducing sugar.
3. Repeat 2, using sucrose solution instead of dextrose. Compare with 2.
4. To 10 ml. sucrose solution, add 3 drops of concentrated hydrochloric acid and boil. Neutralize with sodium carbonate. Test as in 2.
5. To 10 ml. sucrose solution, add ⅛ t. cream of tartar and boil. Neutralize with sodium carbonate. Test as in 2.
6. Repeat 2, using brown sugar solution.

Note color of precipitate in each test. What probable reactions have taken place? Fill in the following chart.

TESTS OF SUGAR SOLUTIONS

Experiment	Color of precipitate	Reaction involved
1. Testing reagents		
2. Dextrose		
3. Sucrose		
4. Sucrose and HCl		
5. Sucrose and cream of tartar		
6. Brown sugar		

E. *Stages of cookery of a sugar sirup.*

Boil without stirring a solution of 1 c. sugar and 1½ cups water. Prevent crystal formation on the sides of utensil by keeping them wiped away with a damp cloth wrapped firmly around a fork, as fast as they form.

Remove the utensil from the fire and test both in very cold water and with a drop on waxed paper at 109, 114, 118, 123, 135, 150, 160, and 170°C. Note change of color as sirup cooks, and resulting cold water test for each stage.

STAGES OF COOKERY OF SUGAR SIRUP

Temperature degrees C.	Color of solution	Cold water test	Drop on paper	Use
109				
114				
118				
123				
135				
150				
160				
170				

F. *Factors affecting the crystallization of sugar.*

1. Boil without stirring the sugar solutions listed below to 114°C. Prevent crystal formation in same manner as in preceding experiment. At the desired temperature, pour half the sirup onto a clean plate to cool, beat the remaining half while still hot until fully crystallized. When other sirup has cooled to 50°C., beat until crystallization is complete.
   a. 1 c. sugar and 1½ c. tap water.
   b. 1 c. sugar and 1½ c. distilled water.
   c. 1 c. sugar, $^1/_{16}$ t. cream of tartar, and 1½ c. distilled water.
   d. 1 c. sugar, ¼ t. soda, and 1½ c. tap water.
   e. 1 c. sugar, 2 tb. white corn sirup, and 1½ c. tap water.

   Compare the color of the sirups in a, b, c, d, and e, as they cook; compare the color of the crystalline products. Record results.

FACTORS AFFECTING CRYSTALLIZATION

Sirups		Crystalline products		
Experiment	Color	Color	Texture	
			Beaten hot	Cooled before beating
a. Sugar and tap water				
b. Sugar and distilled water				
c. Sugar, cream of tartar, distilled water				
d. Sugar, soda, and tap water				
e. Sugar, corn sirup, and tap water				

2. *Influence of interfering substances on spontaneous crystallization.*
Boil the following solutions in a 250-ml. beaker to the concentration of 108°C. Pour into 50-ml. beakers and set aside until the next laboratory period.
   a. 3 tb. sugar and ⅓ c. water.
   b. 3 tb. sugar, 1 t. vinegar, and ⅓ c. water.
   c. 3 tb. sugar, 1 tb. corn sirup, and ⅓ c. water.
   d. 3 tb. brown sugar and ⅓ c. water.
   e. 3 tb. sugar and ⅓ c. distilled water.
   f. 3 tb. sugar, ½ t. gelatin (previously soaked in 10 ml. water), and ⅓ c. water, respectively.

   Will the "hardness" of the tap water affect results in b and d?
3. *Effect of high temperature—"barley sugar."*
Heat slowly ½ c. sugar in a frying pan, stirring constantly until liquid.
   a. Pour one half on a sheet of buttered waxed paper. Compare with product from the sugar solution in E at 160°C.
   b. Add a pinch of soda to the remaining half. Pour out on buttered waxed paper. Compare with a for texture, color, and volume.

Experiments	Texture	Color	Volume
a. Melted, no soda added			
b. Melted, soda added			
c. Sugar solution heated to 160°C.			

1. What is a supersaturated solution?
2. Explain the difference between the size of crystals formed by spontaneous crystallization and those brought about by agitation.
3. What effect does the temperature at the time of agitation have on the size of the crystals?
4. Would you recommend the use of corn sirup in making fondant in every locality? Explain.
5. Why does a brown sugar sirup crystallize less readily than a white sugar sirup?
6. Why is cream of tartar added to fondant?
7. How will the following conditions affect the fondant when cream of tartar is used?
   (a) Reaction of water.
   (b) Amount of water added.
   (c) Temperature of cooking.
   (d) Shallowness of utensil used.
8. Why does the fondant made with hard water have a yellow color?
9. What happens during the process of ripening fondant?
10. What property of levulose affects the consistency of a ripened fondant?
11. What is invert sugar?
12. How does invert sugar affect crystallization in fondant?
13. Explain how each of the following factors influences crystallization and the size of crystals in concentrated sugar products?
   (a) Complete solution.
   (b) Addition of acids.
   (c) Addition of foreign substances as corn sirup, milk, cream, egg white.
   (d) Agitation.
   (e) Temperature at which agitation takes place.
   (f) Introduction of foreign substances in supersaturated solution.
   (g) Ripening.
14. What properties of sucrose make it valuable for use in food preparation?
15. What is the source of each of the following: corn sirup, maple sirup, sorghum, powdered sugar, brown sugar, cerelose?
16. Distinguish between molasses and cane sirup.
17. Compare the mono- and disaccharides in appearance and sweetness.
18. What is barley sugar? For what is it used?
19. What is caramel?
20. Why do foods containing sugar brown easily?

Prepare candies.

1. Crystalline—cream candies having small fine crystals.
   Fudge.
   Fondant.
2. Non-crystalline—amorphous in form, do not crystallize; may have varying degrees of hardness.
   Caramels, soft taffy—chewy texture.
   Brittles, hard taffy—brittle and firm.
3. Special texture—produced by addition of substances, such as egg white, gelatin, or gums.
   Divinity.
   Marshmallows.
   Gumdrops.

STANDARD PRODUCT

Type candy	Appearance	Texture	Flavor
Crystalline			
Non-crystalline			
Special texture			

1. Why is fudge less likely to be grainy than fondant?
2. Explain how the non-crystalline texture of caramels is obtained.
3. Explain how the fondant centers of chocolate creams may be softened.
4. What causes the graying of chocolate on chocolate creams?
5. Why is it necessary to cook fondant made with acid to a higher temperature when it is to be stored for later use?

REFERENCES

AMERICAN HOME ECONOMICS ASSOCIATION, *Terminology Used in Food Preparation*. 1935.
CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 98–108.
HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. VIII.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 262-273.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 34–68.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 308–318.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. II.
SWEETMAN, M. D. *Food Preparation*. Second Edition. Chap. XI.

STARCH

A. *Composition and physical properties of food materials high in starch.*

Food material	Per cent carbohydrate*	Form	Color	Flavor	Source
Arrowroot	87.0				
Cornstarch	87.0				
Potato starch	87.0				
Tapioca	86.4				
Sago meal	83.9				
Rice (white)	79.4				
Flour (cake or pastry)	78.5				
Oatmeal	78.2				
Wheat (cracked)	75.8				
Flour (all purpose)	75.9				
Flour (bread)	74.6				
Corn meal (whole)	73.9				
Macaroni	73.9				

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials*. U.S.D.A. Circular 549.

B. *The microscopic appearance of starch granules from different sources.*
Make a dilute suspension of the starch to be tested. Adjust and observe under the microscope. What differences are noticed?

APPEARANCE OF STARCH GRANULES

Corn	Wheat	Rice	Potato	Arrowroot

C. *The iodine test for starch.*
Add a drop of iodine in solution to the substances as listed in the chart. Record the color change.

COLOR CHANGE WITH IODINE

Moist cornstarch	
Dry cornstarch	
Dry sugar	
Wet sugar	

D. *The solubility of starch.*

Place ⅛ t. of cornstarch in each of the three test tubes. In each test tube add enough of the liquid to fill the tube ½ full and treat as described. Make microscopic drawings.

1. Cold water. Shake well. Observe under microscope. Let stand for 5 min. Record change. Filter and test filtrate for starch.
2. Cold water. Mix well and heat in a hot water bath to 70°C. Record change. Observe under microscope. Let stand for 5 min. Filter and test filtrate for starch.
3. Boiling water. Mix and boil 1 min. Dilute and record change. Observe under microscope. Let stand 5 min., filter and test the filtrate for starch.

SOLUBILITY OF STARCH

Experiment	Effect of heat and water	Filtrate test	Drawing
1. Cold water			
2. Heated to 70°C.			
3. Boiled			

E. *Method of combining starch and hot liquid.*

Use 1 t. cornstarch for each of the following experiments. Treat each as directed. Record results in following chart.

1. Add 1 t. cornstarch to ⅓ c. of boiling water. Bring to boiling temperature. Observe broken lump.
2. Pour ⅓ c. boiling water over 1 t. cornstarch. Bring to boiling temperature. Observe broken lump.
3. Add ⅓ c. boiling water to 1 t. cornstarch well mixed with 1 t. of sugar, stirring constantly. Bring to boiling temperature.
4. Add ⅓ c. boiling water slowly to 1 t. cornstarch well mixed with 1 t. fat, stirring constantly. Bring to boiling temperature.
5. Add ⅓ c. boiling water to 1 t. cornstarch well mixed with 2 t. cold water, stirring constantly. Bring to boiling temperature.

METHODS OF COMBINING STARCH AND HOT LIQUID

Experiment	Appearance
1. Cornstarch in boiling water	
2. Boiling water over cornstarch	
3. Cornstarch mixed with sugar	
4. Cornstarch mixed with fat	
5. Cornstarch mixed with cold water	

F. *The relation between time of cooking and flavor of cornstarch.*

Prepare three starch pastes, using ½ tb. cornstarch mixed with 2 tb. cold water and ½ c. of boiling water. Record time of cooking and the temperature obtained in each case. Compare the flavor of the three pastes with each other and with raw cornstarch.

1. Bring to boiling point, stirring constantly; note time of cooking. Cool.
2. Boil, stirring constantly until it has reached maximum thickness, then boil slowly for 10 min. covered. Cool.
3. Cook in double boiler for 20 min. Cool.

COOKING OF CORNSTARCH PASTES

Experiment	Time of cooking	Temperature	Flavor
1. Brought to boiling point			
2. Boiled 10 minutes			
3. In double boiler			

G. *The formation of dextrin from starch.*

Heat 2 tb. flour (dry) in a frying pan, over a low fire, stirring constantly until a light brown. Some of this browned flour may be reserved for use in Exp. I.

1. Boil 1 t. of browned flour with ¼ c. water. Filter and add alcohol to the filtrate. The white precipitate is dextrin. Filter again and test the residue on the filter paper with iodine. What color is formed? Record.
2. Put 1 t. white corn sirup in 2 tb. water. Test with alcohol for dextrin as above. Record color obtained.

Source of dextrin	Color obtained
1. Browned flour	
2. White corn sirup	

H. *The hydrolysis of starch.*

1. Shake ⅛ t. of cornstarch with 10 ml. water in a test tube. Test for reducing sugar.
2. Mix in a 50-ml. beaker, ⅛ t. of cornstarch and 30 ml. water containing a few drops of concentrated hydrochloric acid. Boil slowly for 5 min. Neutralize with sodium carbonate. Test for reducing sugar. Compare with 1. Explain.

HYDROLYSIS OF STARCH

Material	Result of test
1. Raw starch	
2. Hydrolyzed starch	

I. *The comparative thickening power of starch from different sources.*
Prepare starch pastes from various amounts (½ tb., 1 tb., and 2 tb.) dry material mixed with 1 c. water. Boil each paste 1 min. Compare the thickness and clearness of each when hot and when cold. Record the consistency as very thin, thin, medium, thick, or very thick.

1. ½ tb. cornstarch.
2. 1 tb. cornstarch.
3. 2 tb. cornstarch.
4. ½ tb. all-purpose flour.
5. 1 tb. all-purpose flour.
6. 2 tb. all-purpose flour.
7. 2 tb. cake flour.
8. 2 tb. potato starch.
9. 2 tb. arrowroot starch.
10. 2 tb. minute tapioca.
11. 2 tb. dextrin (browned flour from preceding experiment may be used).

COMPARATIVE THICKENING POWER OF STARCHES

Thickening agent	Amount	Liquid	Consistency		Clearness	Use
			H	C		
1. Cornstarch	½ tb.					
2. "	1 tb.					
3. "	2 tb.					
4. All-purpose flour	½ tb.					
5. " "	1 tb.					
6. " "	2 tb.					
7. Cake flour	2 tb.					
8. Potato starch	2 tb.					
9. Arrowroot starch	2 tb.					
10. Minute tapioca	2 tb.					
11. Dextrin	2 tb.					

TABLE OF WHITE SAUCES

Type	Liquid	Starch	Flour	Fat	Salt	Uses
Thin	1 c.			1 tb.	½ t.	
Medium	1 c.			2 tb.	½ t.	
Thick	1 c.			3 tb.	½ t.	

1. What determines the size and shape of starch granules?
2. What is the common test for starch?
3. What type of system does starch form in cold water? In hot water? Explain.
4. What are the difficulties in making a smooth starch paste? How may they be overcome?
5. Why is starch cooked after its maximum point of swell?

6. What is the effect of excess sugar on the swelling capacity of starch?
7. What is dextrin? What is its relation to starch?
8. Why does dextrin have little thickening power?
9. What is the flour equivalent of cornstarch for thickening? Explain.
10. What is the difference in the texture and clearness of the pastes made from flour and cornstarch?
11. Explain the differences between cornstarch, corn sirup, and corn sugar.
12. What would be the effect of the addition of lemon juice, at the beginning of cooking, on the thickness of a lemon pie filling if starch was used as the thickening agent? Explain.
13. Why does bread toast?
14. Why is brown gravy always thin?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 45, 47–52.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Food*. Revised Edition. pp. 89–92, 104–112.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 402–411.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 194–201, 318–320.
MORGAN, A. F., and HALL, I. S. *Experimental Food Study*. pp. 193–195.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. IV.
SWEETMAN, M. D. *Food Preparation*. Second Edition. pp. 93–97.

Prepare starch puddings and sauces.

STANDARD PRODUCT

Recipe	Appearance	Texture	Flavor
Vanilla cornstarch			
Chocolate cornstarch			
Caramel cornstarch			
Lemon sauce			
Creamed chip beef			

FOODS HIGH IN STARCH

Cereals are the seeds of edible grasses which are used as food. They have a high starch content, and the purpose of cooking is to develop their flavor. The cereal foods made from the whole grain contain the bran, which is largely cellulose. It is made less brittle in the process of cooking the starch. Some cereal foods have been precooked in preparation for the market and therefore require less cooking for the table.

For purposes of food preparation, cereals may be classified as:

1. Raw.
   a. Whole.
   b. Cracked or steel cut.
   c. Granular.
2. Partially prepared.
   a. Rolled or flaked.
      Regular or quick cooking.
   b. Granular.
3. Ready-to-serve.

1. Cereals.

   Weigh and measure three 1-oz. portions of some of the following cereals. Sprinkle each portion into 1 c. boiling salted water (1 t. salt to 1 qt. water) in top part of double boiler. Boil for 2 min. over flame, stirring carefully with rolled cereal to prevent breaking of flakes. Cook one portion 15, one 30, and one 45 min. With raw cereals (wheat, cracked wheat, oatmeal, and corn meal), omit 15 min. period and cook one portion 90 min. Record raw and cooked volume, times increase in cooking, volume of water absorbed, flavor and appearance. Select time of cooking which is best for each type of cereal.

   a. Whole wheat, cracked wheat, oatmeal.
   b. Rolled oats (quick cooking and regular), rolled wheat, cream of rye.
   c. Farina, yellow and white corn meal.
   d. Cook farina, using milk as the liquid.

Cooking Cereals

Type Cereal	Time of cooking	Volume		Time increase	Volume water absorbed	Flavor	Appearance
		Raw	Cooked				
Raw Cracked Whole	Min. 30 45 90						
Raw Granular	30 45 90						
Partially cooked Rolled, quick cooking	15 30 45						
Partially cooked Rolled, regular	15 30 45						
Partially cooked Granular	15 30 45						
Partially cooked Granular in milk	15 30						

STANDARD PRODUCT

Type	Appearance	Texture	Flavor
Raw			
Whole			
Cracked			
Granular			
Partially cooked			
Rolled, quick cooking			
Rolled, regular			
Granular			
Granular in milk			

2. Rice.

Weigh and measure 1-oz. portions of polished rice, brown rice, and wild rice. Wash by placing in a strainer and by running water through it vigorously. Treat each 1-oz. portion in one of the following ways. Compare appearance, flavor, time of cooking. Measure volume of cooked product.

a. Polished rice. Place in 3 c. boiling salted water (1 t. salt to 1 qt. water). Boil rapidly, partially covered, until tender, keeping quantity of water constant. Pour cooked rice into a strainer and let hot water run through it. Set the strainer over steam or dry in oven. Boil down rice water to ½ its volume. Cool and note consistency.
b. Polished rice. Repeat a, adding ¼ t. cream of tartar.
c. Polished rice. Place in upper part double boiler in $^2/_3$ c. boiling salted water. Cook until tender.
d. Polished rice. Cook in milk instead of water in double boiler, as in c.
e. Brown rice. Cook in excess water, as in a.
f. Brown rice. Cook in double boiler, as in c.
g. Brown rice. Soak 1-oz. portion 1 hour. Then cook in excess water, as in a.
h. Wild rice. Cook in excess water, as in a.
i. Wild rice. Cover rice with boiling water (4 c. water to 1 c. rice) and let stand 20 min. Drain. Repeat this process four times, using fresh boiling water each time, and adding salt the last time (2 t. salt to 1 c. rice). Drain.

RICE EXPERIMENT

Experiment	Time of cooking	Volume		Time increase	Appearance	Flavor
		Raw	Cooked			
a. Polished rice, excess water						
b. Excess water plus cream of tartar						
c. Double boiler						
d. Milk, double boiler						
e. Brown rice, excess water						
f. Brown rice, double boiler						
g. Brown rice, presoaked						
h. Wild rice, excess water						
i. Wild rice, steeped						

STANDARD PRODUCT

Method	Appearance	Texture	Flavor	Use
Polished rice in excess water				
Polished rice in double boiler				
Brown rice				
Wild rice				

1. Compare the volume increase in cooking of 1 c. of rolled wheat with 1 c. of farina. Explain.
2. Relate the structure of cereals to their composition.
3. What parts of the grain would you find in puffed wheat, farina, rolled wheat?
4. What parts of the grain would you find in corn flakes, corn meal, corn puffs?
5. What parts of the grain would you find in puffed rice, brown rice, polished rice?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 29, 33–35.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 79–84, 92–103.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. VI.
SWEETMAN, M. D. *Food Preparation*. Second Edition. Chap. IV.

TAPIOCA AND SAGO—MANUFACTURED STARCH PRODUCTS

Tapioca is made from the starch obtained from the roots of the cassava plant, which grows in semi-tropical climates. The starch is removed from the root and made into a dough with water. To make pearl tapioca the dough is forced through a sieve. The size of the sieve determines the size of the pearl tapioca. The dough pellets are dried at a high temperature. To make minute tapioca the dough is baked in thin sheets and then ground.

Sago is a product much like tapioca except that it is prepared from the pith of the sago palm. It is marketed as a meal or as large-sized sago.

Weigh and measure 1 oz. of the various forms of tapioca to be used. Soak one 1-oz. portion of each pearl and granulated tapioca 1 hr. in cold water to cover before using in the following experiment. Record the time of cooking, cooked volume, times increase, and changes in consistency and texture.

a. Pearl tapioca (presoaked). Drain. Add 1 c. boiling salted water. Cook in double boiler without stirring until transparent.
b. Pearl tapioca. Sprinkle 1 oz. unsoaked tapioca into 1 c. boiling salted water. Cook in double boiler without stirring until transparent.
c. Granulated tapioca (presoaked). Repeat a, using soaked granulated tapioca and 1 c. of water.
d. Granulated tapioca. Repeat b, using unsoaked granulated tapioca and 1 c. water.

TAPIOCA EXPERIMENT

Experiment	Time of cooking	Cooked volume	Times increase	Appearance	
				Texture	Consistency
a. Soaked pearl					
b. Unsoaked pearl					
c. Soaked granulated					
d. Unsoaked granulated					

Prepare fruit tapioca.

STANDARD PRODUCT

Appearance	Texture	Flavor

STARCHY PASTES—MANUFACTURED

Macaroni, Spaghetti, and Vermicelli.

Starchy pastes are made from a high-gluten wheat flour mixed with water, kneaded, molded, and dried. They contain a large amount of starch, which must be cooked to develop flavor. Macaroni is that form of the molded paste which has the largest tube; spaghetti, the medium sized; and vermicelli, the smallest tube. The same paste may be made into shells, letters of the alphabet, and other shapes.

Weigh and measure 1-oz. portions of cut macaroni. Soak one portion in cold water to cover for an hour and reserve for part d. Compare results for time of cooking, cooked volume, appearance, and flavor. Record results.

a. Drop 1-oz. cut macaroni into 2 c. boiling salted water. Keeping volume of water constant, boil vigorously until tender.
b. Repeat a, but cook only until it has started to swell and is not fully tender (about 5 min.). Put in baking dish, cover with boiling water, and bake in moderate oven 177°C. (350°F.), for 20 min.
c. Cook 1 oz. in 1 c. boiling salted water in double boiler until tender.
d. Repeat a, using soaked macaroni.

MACARONI EXPERIMENT

Experiment	Time of cooking	Cooked volume	Times increase	Appearance	Flavor
a. Excess water					
b. Excess water and oven					
c. Double boiler					
d. Soaked, excess water					

Prepare macaroni and tomato sauce.

STANDARD PRODUCT

Appearance	Texture	Flavor

FATS

Fats are glycerol esters of fatty acids. The properties of the fats are largely determined by the fatty acids which they contain. These are the acetic acid series, C_nH_{2n+1} COOH, of which butyric, palmitic, and stearic are members, or the unsaturated series, C_nH_{2n-1} COOH, of which oleic acid is a representative; C_nH_{2n-3}COOH, of which linoleic acid is the one found in foods. Each molecule of fat contains one molecule of glycerol and three fatty acid molecules.

If the three fatty acids are the same, the fat is called a simple glyceride. If the fatty acids are unlike, it is a mixed glyceride. The food fats are largely of the latter type. The fatty acids of low molecular weight and the unsaturated fatty acids produce fats, commonly called oils, that are liquid at ordinary temperatures. The fats are insoluble in either hot or cold water, but they are soluble in certain organic liquids, as ether, chloroform, and carbon tetrachloride.

A. *Composition and physical properties of food materials high in fat.*

Kind	Per cent fat*	Form	Color	Flavor	Source
Lard	100				
Compound	100				
Hydrogenated fat	100				
Corn oil	100				
Cottonseed oil	100				
Olive oil	100				
Peanut oil	100				
Suet	94.0				
Butter	81.0				
Oleomargarines	81.0				
Bacon	65.0				
Chocolate	52.9				

* C. Chatfield and G. Adams. *Composition of American Food Materials*. U.S.D.A. Circular 549.

B. *Volatile and fixed fats.*

1. Put one drop of lard on a piece of soft paper, and warm.
2. Repeat 1, using one drop of lemon or peppermint oil.

Describe appearance of the paper in

1. _____
2. _____

C. *Rancidity.*

1. Place a little rancid oil in a test tube, add two or three times (by volume) as much alcohol, and mix thoroughly. Test the liquid with litmus paper. What does rancidity in fats indicate?

   Litmus _____

D. *Emulsification.*

1. Put a few drops of salad oil into a test tube with some water. Shake vigorously.
2. Put a few drops of salad oil into a test tube with some egg yolk slightly diluted with water. Shake vigorously.
3. Put a few drops of salad oil into a test tube with some water and paprika. Shake vigorously.

Examine a drop of each under the microscope, then let the test tube stand and observe a drop again.

EMULSIFICATION

Experiment	Appearance in test tube before standing	Drawing I	Appearance in test tube after standing	Drawing II
1. Oil and water				
2. Egg added				
3. Paprika added				

E. *Melting points.*

Test the melting point of (1) butter, (2) oleomargarine, (3) leaf lard, (4) refined steam rendered lard, (5) compound, (6) hydrogenated oil, in the following manner:

Surround the bulb of a thermometer with the fat. Suspend this over a small beaker resting in a water bath. Heat the water. Record the temperature when the fat drops from the thermometer to the beaker.

If the fat is very soft, use method below:

In a beaker place enough fat to cover completely the bulb of a thermometer. Suspend in a double water bath. The water should reach higher on the beaker than the level

of the fat inside. Suspend a thermometer in the fat so that the bulb is entirely covered with fat without touching the beaker. Heat very gradually. Record the temperature when the fat becomes translucent.

F. *Smoking points.*

Test the smoking or decomposition temperature of (1) butter, (2) oleomargarine, (3) leaf lard, (4) refined steam-rendered lard, (5) compound, (6) a hydrogenated oil, (7) cottonseed oil, (8) corn oil, (9) olive oil, (10) peanut oil, in the following manner:

Place fat in 50-ml. beaker about ⅓ full and suspend the thermometer so that it does not touch the beaker, but so that the bulb is entirely covered. Heat gradually over a low flame and record the temperature when the fat begins to smoke. Hold a piece of blue litmus moistened with distilled water in the fumes. What happens?

NOTE: Butter and oleomargarine are not 100 per cent fat, so more will have to be used in order to cover the bulb of the thermometer after the water has evaporated. Watch butter carefully or it will boil over.

Cool the fat, then reheat and take the smoking point again. Record both smoking points.

MELTING AND SMOKING POINTS OF FATS

Fat	Melting point	First smoking point	Second smoking point	Standard smoking point	Uses
1. Butter					
2. Oleomargarine					
3. Leaf lard					
4. Refined steam-rendered lard					
5. Compound					
6. Hydrogenated oil					
7. Cottonseed oil					
8. Corn oil					
9. Olive oil					
10. Peanut oil					

G. *Test for temperature in frying.*

Bread Cube Test:

Cut uniformly 1-in. cubes of dry bread. Melt fresh fat in a 400-ml. beaker. Cook several bread cubes at each temperature for the number of seconds listed. Be sure to keep cubes immersed in fat for the time required.

1. 175°C. (60 sec.)
2. 185°C. (40 sec.)
3. 195°C. to 200°C. (20 sec.)

Compare both outside and inside appearance of the bread cube. What is responsible for fat soaking in bread? What products are best cooked at the above temperatures? Record results.

RESULTS OF FRYING TEMPERATURES

Experiment	Appearance of cube		Foods cooked at each temperature		
	Outside	Inside	Uncooked	Cooked	Cold wet food
1. 175°C.					
2. 185°C.					
3. 195–200°C.					

H. *Rendering fat.*

Run fat (suet or pork fat) through a food chopper and render as follows:

1. Put 100 gm. in a pan and heat gently.
2. Put 100 gm. in a double boiler and heat.
3. Put 100 gm. in a pan, cover with cold water, and simmer.
4. Put 100 gm. in pan in oven at 205°C. (400°F.) for 30 min.

When fat is well freed from connective tissue, strain through a dry cheesecloth into a weighed 100-ml. beaker. Weigh fat. Record results.

RENDERING FAT

Experiment	Weight after cooking	Per cent fat	Color	Clearness	Time for rendering
1. Fat in pan with direct heat					
2. Fat in double boiler					
3. Fat in water simmered					
4. Fat in pan in oven					

I. *Cooking of food high in fat.*

Select three uniform slices of bacon. Cook in various ways as indicated. Record results.

1. Place a strip of bacon in a cold frying pan and cook at a low temperature until golden brown. Turn frequently. Drain and pour drippings into a beaker.
2. Preheat a frying pan. Cook a strip of bacon maintaining a high temperature. Turn frequently. Drain. Pour drippings into a beaker.
3. Place a strip of bacon on a small rack in a shallow baking pan. Bake in an oven preheated to 177°C. (350°F.) Turn once. Pour drippings into a beaker.

COOKING BACON

Method	Bacon		Drippings	
	Flavor	Curling	Color	Usability
1. Pan broiled: low temperature				
2. Pan broiled: high temperature				
3. Oven cooked: moderate temperature				

J. *Cream.*

1. Microscopic examination.

Compare under a microscope a drop of homogenized and plain cream and a drop of skimmed milk. Note the size and number of fat globules. Show by drawings these variations.

SIZE AND NUMBER OF FAT GLOBULES

Homogenized cream	Plain cream	Skimmed milk

2. Whipping of cream.
   a. Chill ⅓ c. of light cream to 10°C. and then whip. Return to measuring cup for comparison.
   b. Chill ⅓ c. of heavy cream to 10°C. and then whip. Return to measuring cup for comparison.
   c. Warm ⅓ c. of heavy cream and whip. Return to measuring cup for comparison.
   d. Chill ⅓ c. homogenized light cream to 10°C. and then whip. Return to measuring cup for comparison.
   e. Preheat evaporated milk in the can. Chill ⅓ c. of this preheated milk to 10°C. and then whip. Return to measuring cup for comparison.

   Compare foams for ease of whipping, volume increase, and stability of foam. Record results.

WHIPPED CREAM FOAMS

Experiments	Time to whip	Whipped volume	Volume increase	Stability of foam
a. Chilled light cream				
b. Chilled heavy cream				
c. Warmed heavy cream				
d. Chilled homogenized light cream				
e. Chilled preheated evaporated milk				

1. What is fat? An oil?
2. Upon what does the melting temperature of a fat depend?
3. Why is the melting point of butter lower than that of lard? Of olive oil lower than that of suet?
4. What causes rancidity? What influence does it have on the smoking point of a fat?
5. What is the effect of re-using fat on its smoking point?
6. Is the smoking of a fat any indication of its temperature? Explain.
7. What is the basis for selection of a fat for deep-fat-frying?

8. Name the fats that may be used for (a) table, (b) deep-fat-frying, (c) pan-frying, (d) salad dressing.
9. Define an emulsion.
10. What kind of an emulsion is French dressing? Explain.
11. What kind of an emulsion is mayonnaise? Explain.
12. Why is some of the acid added before emulsification in mayonnaise?
13. What is the difference, other than color, between a mayonnaise made with egg yolk and the whole egg?
14. What limits the amount of oil that can be added in mayonnaise?
15. What causes the mayonnaise to become thick?
16. Explain why freezing breaks the emulsion in mayonnaise.
17. Why should mayonnaise be kept tightly covered?
18. Why does frozen cream form globules of fat on top of a cup of coffee?
19. What is meant by light cream?
20. What is meant by heavy cream?
21. Explain what happens when cream whips.
22. Explain why homogenized cream does not whip.
23. Why won't light cream form a stiff foam?
24. Explain why cream should be cold to whip. Why it should not be too fresh.
25. Why does evaporated milk not show a cream line?
26. Summarize the uses of fat in cooking.

Prepare salads and salad dressings.

Dressings.
- Mayonnaise.
  - Variations.
- French dressing.
  - Variations.

Salads.
- Vegetable.
- Fruit.
- Cheese.
- Egg.
- Fish.
- Chicken.
- Meat.

STANDARD PRODUCT

Appearance	Texture	Flavor

REFERENCES

HILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 6–7.
USTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 26, 183–184, 280–289.
OWE, B. *Experimental Cookery*. Second Edition. Chaps. VIII and XIII. pp. 298–300.
IACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. Chap. XXXII, pp. 401–402.
IORGAN, A. F., and HALL, I. S. *Experimental Food Study*. pp. 336–342, 356–362.
WEETMAN, M. D. *Food Preparation*. Chap. IX. pp. 228–232.

FRUITS

As plants mature, they produce seeds. Surrounding the seed often is found a pulp which is edible. Most of our food fruits have been cultivated so that this pulp is very attractive in appearance, texture, and flavor when ripe. The red, blue, and purple colors of fruits are due to anthocyanin pigments, the yellow and orange-yellow colors to xanthophylls and carotene, the watermelon red to lycopene and the cream or pale yellow to flavones, which develop as the fruit ripens. The structural parts of the fruit are celluloses. Dispersed in the cell fluid are found sugar, both mono- and disaccharides, protein, fat, organic acid salts, vitamins, tannins, and volatile organic compounds which give the characteristic flavor to the fruit. In the space between the cell walls are varying amounts of substances generally called pectins. The acids found in greatest amount in fruits are citric, malic, tartaric, and succinic. There are enzymes in fruits which may bring about discolorations when the raw fruit surface is exposed to the air.

Fruits are preserved commercially by drying, in which method the amount of water is reduced by natural or artificial means until it is below that which will support the growth of micro-organisms. Canning and preserving with sugar are other methods of preservation.

Some fruits are kept for short periods in cold storage, and more recently the method of preservation by freezing has been extended to many of the more perishable fruits.

FRESH FRUITS

A. *The effect of method of cooking upon retention of flavor and shape.*

Use small berries or large fruits (rhubarb, apples that cook up easily) cut in small uniform pieces. Prepare 5 c. fruit, mix and measure 1 c. for each experiment. Use same size saucepan for cooking 1, 2, and 5. For 2 and 5 use same rate of cooking in order to have approximately the same amount of juice left. Use ½ c. water with berries or rhubarb. Treat individually as follows:

1. Cook 1 c. fruit with 1 c. water in covered saucepan, boiling *rapidly* until just tender.
2. Cook 1 c. fruit with 1 c. water in covered saucepan, boiling *slowly* until just tender.
3. Cook 1 c. fruit with 1 c. water in double boiler until tender.
4. Cook 1 c. fruit with 1 c. water in covered casserole in the oven at 177°C. (350°F.)
5. Cook 1 c. fruit with 1 c. water in uncovered saucepan boiling slowly until just tender.

Record results for time of cooking, retention of shape, translucency and strength of flavor in juice and fruit. What method gives the most desirable sauce?

COOKING FRESH FRUIT SAUCE

Experiment	Time of cooking	Appearance		Texture	Flavor
		Shape	Translucency		
1. Boil rapidly, covered					
2. Boil slowly, covered					
3. Double boiler					
4. Casserole in oven					
5. Boil slowly, uncovered					

B. *The effect of adding sugar to fresh fruit in the cooking process.*
Use a fairly firm fruit and the same proportions—1 c. fruit to 1 c. water. If large fruits are used cut in large pieces, preparing 4 c. fruit. Mix and measure 1 c. for each experiment. Cook in saucepans of the same size. Use method 2 in preceding experiment.

1. Use one half as much sugar as fruit by weight. Cook fruit until tender. Add sugar at end of cooking.
2. Use one half as much sugar as fruit by weight. Boil sugar and water together for 2 min. Cook fruit in this sirup until tender.
3. Use one half as much sugar as fruit by weight. Add sugar to fruit at beginning of cooking process. Cook until tender.
4. Use equal weights sugar and fruit. Boil sugar and water together for 2 min. Cook fruit in this sirup until tender.

Compare products for time of cooking, retention of shape, translucency, flavor of fruit and juice. Record. What method is best for stewed fruit? For a fruit preserve?

COOKING STEWED FRUIT

Experiment	Time of cooking	Appearance		Texture	Flavor
		Shape	Translucency		
1. Sugar, water 1 to 2, add at end cooking					
2. Sugar, water 1 to 2, sirup					
3. Sugar, water 1 to 2, add when put on to cook					
4. Sugar, water 1 to 1, sirup					

C. *Retention of shape in baking fresh fruit.*

Use apples or similar fruit. Wash and core apples. Put into baking pan, pour into cavity 1 tb. sugar mixed with ¼ to ½ t. cinnamon per apple. Add water to a depth of ½ inch. Cover and bake in a moderate oven 177°C. (350°F.) until soft. Compare products for retention of shape, texture and flavor.

Before baking prepare apples in various ways listed below:

1. Pare entire apple.
2. Pare half of apple from blossom to center.
3. Wash and core, but do not pare or score.
4. Wash and core but do not pare apple. Score with a circular cut through the skin around the middle.
5. Repeat 4 but "bake" on top of the stove instead of in the oven.

BAKING FRESH FRUIT

Experiment	Appearance (shape)	Texture	Flavor
1. Entirely pared			
2. Half pared			
3. Unscored			
4. Scored			
5. Top stove "baking"			

Write method for preparing:

Apple sauce _____

_____

_____

Baked apples _____

_____

_____

Stewed apples _____

_____

_____

STANDARD PRODUCT

Form	Appearance	Texture	Flavor
Sauce			
Stewed fruit			
Baked fruit			

1. Why is less water used in cooking berries and rhubarb than in cooking apples and pears?
2. Give conditions of cooking for maximum retention of flavor in fruits.
3. Give conditions for cooking fruit to retain its shape.
4. Why do fruits cooked in sirup become more firm in texture?
5. Explain the difference in texture of canned pears and pear preserves.
6. Why do some blue plums become red when cooked?
7. Why does grape punch often become blue when made with tap water? How could the purple color be returned?
8. Why do fruits become more transparent when cooked in sirup?
9. What happens to sucrose when it is cooked with fruits?
10. Why are enameled-lined cans used in the canning of loganberries and strawberries?

DRIED FRUITS

A. *The effect of soaking upon time of cooking, texture, and the flavor of dried fruits.*

Use prunes, apricots, figs, and raisins. Wash dried fruit in a limited amount of hot water. Weigh 100 gm. dried fruit for each experiment before washing. Use same size saucepans and cook covered at same rate of speed for all methods. Treat each portion as follows:

1. Soak fruit 24 hrs.; cook until tender.
2. Pour boiling water over washed fruit and let soak for 1 hr. Cook until tender.
3. Cook unsoaked fruit until tender.
4. Cook unsoaked tenderized fruit until tender.

Compare results for plumpness, tenderness of skin, richness of flavor in fruit and juice. Judge relative amount of water absorbed in each case.

EFFECT OF SOAKING DRIED FRUITS

Fruits	Weight	Time of soaking	Time of cooking	Amount water absorbed	Appearance and texture	Flavor
Prunes	100 gm.	24 hrs. 1 hr. none				
Apricots	100 gm.	24 hrs. 1 hr. none				
Figs	100 gm.	24 hrs. 1 hr. none				
Raisins	100 gm.	24 hrs. 1 hr. none				

STANDARD PRODUCT

Fruit	Appearance	Texture	Flavor
Dried fruit			

1. What is the object in soaking dried fruits?
2. What are the results of over-soaking?
3. Is it necessary to soak all dried fruits?
4. What factors influence the amount of soaking needed by different dried fruits?
5. When should sugar be added to dried fruits? Why?
6. Do all dried fruits need added sugar?
7. How should dried fruits be kept in the home?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 26–28.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 57–77.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 103–110.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. III.
SWEETMAN, M. D. *Food Preparation*. Second Edition. pp. 141–148.
WILMOT, J. S., and BATJER, M. Q. *Food for the Family*. pp. 43–60.

VEGETABLES

Vegetables consist of the edible parts of herbaceous plants, such as their roots, tubers, bulbs, stalks, seeds, leaves, flowers, and fruit. The parts of the plant that are used for storage generally contain more starch and protein, whereas the leaves, stalks, and fruits are more succulent. The vegetables resemble fruits in structure and composition except that there is more starch and less sugar and acid in vegetables. They contain tannins and the same pigments that are found in fruits. In addition, the green vegetables contain the pigment chlorophyll.

Vegetables are particularly attractive in the diet, because of their variety of color and flavor, and the succulent vegetables' crispness, which should be retained in cooking.

STARCHY VEGETABLES

A. *Structure.*

1. Wash a potato and cut in half crosswise. Make a drawing of the cross section and label parts.
2. Weigh each half before and after paring.
   a. Pare one half carefully.
   b. Pare one half carelessly.
   Calculate the per cent of loss in each case.
3. Stain a very thin slice of potato with iodine and examine under the microscope. Note the distribution of starch and cellulose. Draw.

STRUCTURE OF POTATOES

Cross section of potato	Results of paring				Stained potato slice
	Carefully		Carelessly		
	Grams loss	Per cent loss	Grams loss	Per cent loss	

B. *Composition.*

1. Grate a small piece of pared potato into cheesecloth. Wash in a bowl of water until nothing more can be extracted. Let the bowl of water stand. Examine the sediment under the microscope. Make a drawing of it. Test some of the sediment with iodine. Note change. Boil some sediment in water in a test tube. Record result. Examine the contents in the cloth.
2. Add a few drops of concentrated nitric acid to a little chopped potato in a test tube. Boil and cool. Add ammonium hydroxide. The development of an orange color shows the presence of protein. This is the xanthoproteic test.
3. Place 25 gm. of chopped potato in a weighed crucible and burn until only a grayish-white ash remains. Weigh crucible and ash. Calculate per cent ash.
4. Test some chopped potato for reducing sugar.

Record results.

COMPOSITION OF POTATOES

Grated potato	Iodine test	Sediment boiled	Protein test	Per cent ash	Sugar test

C. *Preparation of potatoes—boiling.*

1. Pare three potatoes of uniform size. Put on to cook in cold water which completely covers potatoes. Use 1 t. salt to 2 c. water. Cook until tender. Drain. Take the interior temperature of one. Remove a second to a pan and cover with a lid. Remove lid from third and set over a low flame until potato is dry.
2. Repeat 1, but start the cooking in boiling water.
3. Scrub three medium-sized potatoes. Cook unpared in boiling salted water until done. Treat as in 1.
4. Scrub three medium-sized potatoes. Cut a ring of skin from around center of each potato. Cook in boiling salted water until done. Treat as in 1.
5. Scrub three medium-sized potatoes. Cook in steamer until tender. Treat as in 1.

Record time of cooking, texture, flavor, color, and interior temperature for all experiments.

BOILED POTATOES

Experiment	Time of cooking	Texture		Flavor	Color	Interior temperature
		Dried with lid	Dried without lid			
1. Pared, started in cold water						
2. Pared, started in boiling water						
3. Unpared, boiled						
4. Ring pared, boiled						
5. Unpared, steamed						

STANDARD PRODUCT

	Appearance	Texture	Flavor
Boiled potatoes			
Steamed potatoes			

D. *Preparation of potatoes—baking.*

1. Scrub two potatoes of uniform size. Rub skin with fat. Bake in a preheated oven at 230°C. (450°F.) until tender. Take interior temperature of one immediately upon removal from oven. Break open the skin. Allow second to stand without breaking skin.
2. Repeat 1, baking in an oven heated to 185°C. (365°F.).
3. Repeat 1, starting with a cold oven and heating to 260°C. (500°F.).

Record time of cooking, texture, appearance, flavor, and interior temperature for all experiments.

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BAKED POTATOES

Experiment	Time of cooking	Texture		Appearance	Flavor	Interior temperature
		Broken skin	Unbroken skin			
1. Preheated oven, 450°F.						
2. Preheated oven, 365°F.						
3. Cold start heated to 500°F.						

1. Why can potatoes be baked?
2. Why do baked potatoes have a different flavor from boiled potatoes?
3. Give conditions for boiling potatoes to give maximum mealiness.

Prepare potatoes—Mashed, stuffed baked, creamed, French fried, chips.

STANDARD PRODUCT

Potato variations	Appearance	Texture	Flavor
Mashed			
Stuffed baked			
Chips			
Creamed			
French fried			

SUCCULENT VEGETABLES

A. *Freshening of vegetables.*

1. Soak a wilted leaf of lettuce in ice water for 40 min.
2. Soak a wilted leaf of lettuce in cold water over night. Hold in refrigerator.

FRESHENING WILTED VEGETABLES

Experiment	Appearance	Texture
1. 40 min.		
2. Over night		

B. *Keeping vegetables fresh.*

1. Wash a crisp lettuce leaf. Put into an airtight jar and allow to remain over night.
2. Wash a crisp lettuce leaf. Wrap in waxed paper. Hold in refrigerator over night.

KEEPING VEGETABLES FRESH

Experiment	Appearance	Texture	Vegetables to be kept fresh by method
1. Airtight jar			
2. Waxed paper			

C. *Effect of salt on raw vegetables.*

1. Soak thin slices of cucumber in cold salted water for 1 hr.
2. Soak thin slices of cucumber in cold water for 1 hr.

Compare the slices in texture and flavor. Which product is most satisfactory for salad?

SOAKING VEGETABLES IN SALT WATER

Experiment	Texture	Flavor
1. Salt water		
2. Cold water		

D. *Composition.*

Test spinach, onions, cabbage, and carrots for the presence of starch, sugar, and protein.
Ash 25 gm. of each to judge mineral content.
Record results.

FOOD CONSTITUENTS PRESENT IN VEGETABLES

Vegetable	Starch	Sugar	Protein	Mineral salts
Spinach				
Onions				
Cabbage				
Carrots				

E. *The effect of cooking upon color, flavor, and texture of fresh vegetables.*

1. The effect of method of cooking upon vegetable pigments.
Use a yellow, a white, a red, and a green vegetable for the following experiments. Carrots, white onions, red cabbage, and spinach are satisfactory. Use 1 c. raw vegetable for each experiment. Shred cabbage fairly fine and pack the cup uniformly in measuring. Pack spinach in cups also. Cut onions in uniform segments (4ths for average size) and carrots in uniform slices crosswise. Put on to cook in boiling water, bring back to boil rapidly and cook until just tender. Keep the size of saucepans uniform for each vegetable. Keep amounts of water (large and small) uniform throughout. Use the following variations in method, and record results in appropriate charts.

a. Large amount of tap water in a covered pan.
b. Large amount of tap water in an uncovered pan.
c. Small amount of tap water in a covered pan.
d. Small amount of tap water in an uncovered pan.
e. Steamer.
f. Pressure saucepan.
g. Small amount of *distilled* water in an uncovered pan.
h. Small amount of *distilled* water plus vinegar (1 t. per cup water) in an uncovered pan.
i. Small amount of *distilled* water plus soda (½ t. per cup water) in an uncovered pan.

CHLOROPHYLL (GREEN PIGMENT)

Experiment	Color of vegetable	Cooking liquid	
		Color	Reaction
a. Large amount water, covered			
b. Large amount water, uncovered			
c. Small amount water, covered			
d. Small amount water, uncovered			
e. Steamer			
f. Pressure saucepan			
g. Small amount distilled water, uncovered			
h. Small amount acidified water, uncovered			
i. Small amount water plus soda, uncovered			

CAROTENE (ORANGE-YELLOW PIGMENT)

Experiment	Color of vegetable	Cooking liquid	
		Color	Reaction
a. Large amount water, covered			
b. Large amount water, uncovered			
c. Small amount water, covered			
d. Small amount water, uncovered			
e. Steamer			
f. Pressure saucepan			
g. Small amount distilled water, uncovered			
h. Small amount acidified water, uncovered			
i. Small amount water plus soda, uncovered			

FLAVONE (WHITE PIGMENT)

Experiment	Color of vegetable	Cooking liquid	
		Color	Reaction
a. Large amount water, covered			
b. Large amount water, uncovered			
c. Small amount water, covered			
d. Small amount water, uncovered			
e. Steamer			
f. Pressure saucepan			
g. Small amount distilled water, uncovered			
h. Small amount acidified water, uncovered			
i. Small amount water plus soda, uncovered			

ANTHOCYANIN (RED PIGMENT)

Experiment	Color of vegetable	Cooking liquid	
		Color	Reaction
a. Large amount water, covered			
b. Large amount water, uncovered			
c. Small amount water, covered			
d. Small amount water, uncovered			
e. Steamer			
f. Pressure saucepan			
g. Small amount distilled water, uncovered			
h. Small amount acidified water, uncovered			
i. Small amount water plus soda, uncovered			

2. The effect of method of cooking upon texture and flavor of fresh vegetables. Use a yellow, a white, a red, a green vegetable, and a vegetable from the cabbage family. Carrots, white onions, red cabbage, spinach, and green cabbage are satisfactory. Use two cups vegetable for each experiment. Prepare in same manner as for previous experiments. Use the following variations in method, cook only until just tender unless otherwise directed. Record results.
   a. Small amount of water in a covered pan.
   b. Small amount of water in an uncovered pan.
   c. Large amount of water in an uncovered pan.
   d. Large amount of water in an uncovered pan cooked 1 hr.
   e. Steamer.
   f. Pressure saucepan.
   g. Small amount of water plus vinegar (1 t. per cup water) in an uncovered pan.
   h. Small amount of water plus soda (½ t. per cup water) in an uncovered pan.
   i. Small amount of milk in an uncovered pan.

GREEN VEGETABLE

Experiment	Time of cooking	Flavor	Texture
a. Small amount water, covered			
b. Small amount water, uncovered			
c. Large amount water, uncovered			
d. Large amount water, uncovered	1 hr.		
e. Steamer			
f. Pressure saucepan			
g. Small amount water plus soda			
h. Small amount water plus vinegar			
i. Small amount milk, uncovered			

WHITE VEGETABLE

Experiment	Time of cooking	Flavor	Texture
a. Small amount water, covered			
b. Small amount water, uncovered			
c. Large amount water, uncovered			
d. Large amount water, uncovered	1 hr.		
e. Steamer			
f. Pressure saucepan			
g. Small amount water plus soda			
h. Small amount water plus vinegar			
i. Small amount milk, uncovered			

YELLOW VEGETABLE

Experiment	Time of cooking	Flavor	Texture
a. Small amount water, covered			
b. Small amount water, uncovered			
c. Large amount water, uncovered			
d. Large amount water, uncovered	1 hr.		
e. Steamer			
f. Pressure saucepan			
g. Small amount water plus soda			
h. Small amount water plus vinegar			
i. Small amount milk, uncovered			

RED VEGETABLE

Experiment	Time of cooking	Flavor	Texture
a. Small amount water, covered			
b. Small amount water, uncovered			
c. Large amount water, uncovered			
d. Large amount water, uncovered	1 hr.		
e. Steamer			
f. Pressure saucepan			
g. Small amount water plus soda			
h. Small amount water plus vinegar			
i. Small amount milk, uncovered			

CABBAGE FAMILY

Experiment	Time of cooking	Flavor	Texture
a. Small amount water, covered			
b. Small amount water, uncovered			
c. Large amount water, uncovered			
d. Large amount water, uncovered	1 hr.		
e. Steamer			
f. Pressure saucepan			
g. Small amount water plus soda			
h. Small amount water plus vinegar			
i. Small amount milk, uncovered			

1. How may vegetables be kept fresh?
2. Why do mechanical refrigerators have hydrators for storing vegetables?
3. Does salt penetrate a vegetable more when it is raw or cooked?
4. When should vegetables be salted?
5. Should cucumbers be soaked in salt water before serving? Explain.
6. What factors enter into the palatability of vegetables?
7. What causes loss of desirable texture in cooking succulent vegetables?
8. Explain how flavor of vegetables can be impaired in cooking.
9. How does the acidity of the medium of cooking affect the nutritive value?
10. Explain why long cooking of vegetables would decrease their nutritive value.
11. Why do vegetables of the cabbage family have particularly poor flavor when over-cooked?
12. Why does cabbage retain its green color when cooked in milk?
13. Why do vegetables become tender more rapidly when cooked in alkaline water?
14. Make a list of vegetables which may be cooked in a steamer.
15. How can the liquid in which vegetables are cooked be utilized?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition, pp. 29–43.
HALLIDAY, E. G., and NOBEL, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. I.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 122–143.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 103–120, 126–129.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. pp. 337–393.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. V.
SWEETMAN, M. D. *Food Preparation*. Second Edition. pp. 141–158.

Prepare vegetables: buttered, creamed, au gratin, fried, stuffed, panned.

STANDARD PRODUCT

Method	Appearance	Texture	Flavor
Buttered			
Creamed			
Au gratin			
Fried			
Stuffed			
Panned			

1. Why should the vegetable be dry when a white sauce is added?
2. Explain how the liquor from cooking vegetables can be used in their preparation.
3. What causes the crumbs on a scalloped vegetable to brown?

Prepare creamed vegetable soups.

STANDARD PRODUCT

Type	Appearance	Texture	Flavor
Celery			
Asparagus			
Spinach			
Corn			
Snap bean			

1. What is the foundation of cream soups?
2. What is the function of the flour?
3. Why is the amount of flour lessened when potatoes are used? What other vegetables would reduce the amount of flour used?
4. What is the difference between a purée and a cream soup?
5. Why do some vegetable soups curd on long heating?
6. When should the vegetable stock and white sauce be combined?
7. How can the butter be prevented from forming in oil droplets on the top of the soup?

PROTEINS

Proteins are foodstuffs synthesized by both plants and animals: by plants, from the nitrogen of inorganic salts, carbon dioxide, and water; by animals, from amino acids, which are the cleavage products of the proteins ingested by the animal. All the proteins contain carbon, hydrogen, oxygen, and nitrogen. Most of them contain sulfur; and a few, phosphorus and iron. Proteins may be hydrolyzed to a mixture of amino acids. This hydrolysis does not take place under ordinary conditions of cookery.

Proteins are amphoteric because of the amino groups, NH_2, and the carboxyl groups, COOH, which they contain; they are capable of forming salts with both acids and bases. Although the different proteins vary greatly, certain properties are common to all. They all form colloidal solutions, although the dissolving medium varies for the different proteins.

This difference in solubility is used as a basis for classification of the simple proteins found in foods.

Simple proteins.

1. Albumin—soluble in water. Source: egg white, milk, meat, plant tissue.
2. Globulins—soluble in dilute salt solution. Source: meats and plant tissue.
3. Glutelins—soluble in weak acids and alkalis. Source: vegetable tissue; glutenin—wheat.
4. Prolamins—soluble in 70 per cent alcohol. Source: vegetable tissue; gliaden—wheat.
5. Albuminoids—insoluble in ordinary solvents. Collagen may be hydrolyzed into gelatin, also a protein, by heating in either acid or alkaline water. Elastin is not affected by acids or alkalis. Source: skeletal tissue of animals—collagen and elastin.

If the proteins are combined with some other molecule, they are called conjugated proteins.

Conjugated proteins.

1. Phosphoprotein. Source: casein in milk; vitellin in eggs.
2. Hemoglobin. Source: blood.

There are other simple and conjugated proteins, but as food proteins they are not so important.

Foods containing proteins in important amounts are meat, poultry, fish, eggs, milk, cheese, nuts, legumes, and cereals.

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 54–55.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 25–26.

MacLeod, A. L., and Nason, E. H. *Chemistry and Cookery.* Chap. XXXVI.
Morgan, A. F., and Hall, I. S. *Experimental Food Study.* Chap. XX.
Stanley, L., and Cline, J. A. *Foods: Their Selection, Preparation and Use.* Chap. I.
Sweetman, M. D. *Food Preparation.* Second Edition. pp. 5–9.

EGGS

The important proteins of eggs are the albumin of the white and the vitellin of the yolk. The value of eggs in cookery is largely dependent upon the properties of these two proteins, which are present in colloidal form. The yolk contains, besides the protein, all the fat of the egg. It is emulsified, and a large part of it is in the form of lecithin. The larger part of the mineral and most of the vitamin content is in the yolk. The color of the shell and the size of the egg depend upon the breed of the hen; but the color, flavor, and vitamin content of the yolk presumably depend upon the diet of the hen.

A. *Composition—per cent (edible portion).**

	Protein	Fat	Carbohydrate	Water	Ash
Whole	12.8	11.5	0.7	74.0	1.0
White	10.8	0.0	0.8	87.8	0.6
Yolk	16.3	31.9	0.7	49.4	1.7

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials.* U.S.D.A. Circular 549.

B. *The structure of eggs.*

1. Shell. Wash an egg in water and in carbon tetrachloride. Place the dry egg in a solution of carmine to which enough hydrochloric acid has been added to make it decidedly acid. Boil 15 min. Cool, carefully remove shell, and examine the inner surface of the membrane lining.
2. Inner structure. Break an egg carefully into a glass dish and examine the inside and contents of the shell.
   a. Note membranes and air sac.
   b. Yolk and its cords (chalazae), germ spot, texture, and color.
   c. Layers of white—texture and color.

C. *The quality of eggs.*

Compare eggs from each of the U. S. retail grades for size, strength of shell, standing up quality of yolk, thickness of white, and cost. Record results.

QUALITY COMPARISONS OF GRADED EGGS

U. S. Grade	Size	Shell	Quality		Cost
			Yolk	White	
U. S. Special—AA					
U. S. Extra—A					
U. S. Standard—B					
U. S. Trade—C					

Demonstrate the use of a candler as a means of determining egg quality. Note character of shell, color, and mobility of egg yolk.

D. *Weights and measures of eggs.*
Select an egg from each grade, weigh and measure the whole egg, the white, and the yolk of each. Record results.

WEIGHTS AND MEASURES OF EGGS

U. S. Grade	Whole egg		White		Yolk	
	Weight grams	Measure	Weight grams	Measure	Weight grams	Measure
U. S. Special						
U. S. Extra						
U. S. Standard						
U. S. Trade						

E. *Properties of egg proteins.*
1. Solubility. Place ½ t. of egg white, which has been divided by cutting with the scissors, in a test tube. Add 10 ml. water. Shake, filter. Boil the filtrate. Note any change.
2. Coagulation without heat. Dilute an egg white with four times its volume of water.

Measure out 10 ml. in a test tube. Add a little vinegar. What happens? Repeat, using salt instead of vinegar. Record results of 1 and 2.

PROPERTIES OF EGG PROTEINS

Egg protein	Solubility	Coagulation	
		With acid	With salt
Diluted egg white			

3. Coagulation with heat. Place 1 t. of egg white in test tube. Suspend in a double water bath, bring surface of egg in the tube a little below the level of the surface of the water. Heat the water slowly. Note the temperature and consistency at the following stages. Carry through the same experiments for egg yolks. Record results.
   a. Temperature at which coagulation is first apparent.
   b. Temperature at which whole mass is coagulated.
   c. Consistency of mass in b, determined by removing some from test tube.
   d. Consistency of mass after heating 10 min.

COAGULATION TEMPERATURES AND CONSISTENCIES

	Temp. of coagulation		Consistency	
	First	Full	First coagulation	Full coagulation
Egg White				
Egg yolk				

F. *The cooking of eggs in water.*
   1. Outside the shell. Use a whole egg white or a whole egg for each of the following experiments. Compare and record results, then formulate a satisfactory method for poaching eggs.
      a. Heat a pint of water in a saucepan to 80°C. Carefully slide 1 egg white from a saucer into the heated water. Cover with a lid and turn out the flame. Hold 3 minutes.
      b. Repeat a, but have the water boiling at the beginning of the experiment.
      c. Repeat b, but allow water to continue boiling for 3 min.

EGGS COOKED OUTSIDE THE SHELL

Experiment	Coagulation	Texture
a. Water heated to 80°C.		
b. Water heated to boiling		
c. Water boiled for 3 min.		

Prepare poached eggs: use eggs from different grades.

2. In the shell.

Soft cooked:

Wash the eggs thoroughly. Put water into a deep saucepan fitted with a lid. Use 1 pt. water for each egg and 1 c. extra for each additional egg. Record the temperature of the water and interior temperature of the egg in each case.

a. Place an egg in cold water and bring to the boiling point as quickly as possible.
b. Place an egg in boiling water and boil 3 min.
c. Place an egg in boiling water, immediately turn out the flame, cover the pan and allow to stand for 7 min.
d. Place an egg in boiling water, lower the flame so that simmering temperature is maintained. Remove after simmering 5 min.

EGGS SOFT COOKED IN THE SHELL

Experiment	Temperature of water	Interior temperature	Texture egg white	Consistency egg yolk
a. Cold water to boiling				
b. Boiled 3 min.				
c. Cooked 7 min.				
d. Simmered 5 min.				

Hard cooked:

a. Place 3 eggs in boiling water and boil for 15 min. Take the interior temperature of one. Cool the second rapidly in cold water. Let the third cool gradually in the air at room temperature. Is there any difference in the ease of peeling the eggs? Is there any difference in the color at the junction of the yolk and white?
b. Place 2 eggs in boiling water in top part of double boiler and place upper in lower

part which also contains boiling water. Turn out the flame. Let stand covered for 40 to 45 min. Take interior temperature of one. Cool the second in cold water. Compare with products from a, for texture of white, color, and texture of yolk.

c. Place 2 eggs in boiling water in top of double boiler. Cook in double boiler for 20 min. Use one egg to record interior temperature; allow it to cool at room temperature. Cool second rapidly in cold water.

d. Cover 2 eggs with boiling water. Simmer without a lid for 25 min. Take interior temperature of one, allow it to cool at room temperature; cool the second rapidly in cold water.

Compare eggs from above experiments for texture of the white and yolk, also for the color of the yolk. Record the temperature of the cooking water and the interior temperature of the eggs.

EGGS HARD COOKED IN THE SHELL

Experiment	Temperature of water	Temperature of egg interior	Texture egg white	Color, texture yolk	
				Cooled rapidly	Cooled slowly
a. Boiled 15 min.					
b. Cooked 40 to 45 min.					
c. Double boiler 20 min.					
d. Simmered 25 min.					

STANDARD PRODUCT

	Appearance	Texture
Soft cooked		
Hard cooked		

3. Fried.

a. Cook an egg over a low flame with only enough fat to prevent sticking (½ t. or less) until the white is just coagulated.

b. Repeat a, cooking until the yolk is coagulated.

c. Repeat a, using enough fat to almost cover the white. Baste the yolk with hot fat.

d. Repeat c, cooking very rapidly until the entire egg is coagulated.

e. Cook egg covered, with ½ t. butter, or add a few drops of water to form steam.

VARIOUS METHODS OF FRYING EGGS

Experiment	Texture of white	Texture of yolk
a. White, just coagulated		
b. Yolk, coagulated		
c. Cooked with basting		
d. Entirely coagulated		
e. Cooked with steam		

STANDARD PRODUCT

	Appearance	Texture	Flavor
Soft fried			
Hard fried			

G. *Eggs as a leavening agent.*

Select eggs of equivalent size and measure for the following experiment, or using the 48-gm. egg (18-gm. yolk, 30-gm. white) as the standard, weigh out 30 gm. egg white and 18 gm. egg yolk for each part of the experiment. Note and record the volume and the size of air cells in each.

1. Beat 1 egg white with a flat egg whip until stiff yet still moist. Beat yolk with small whip or a fork until thick and lemon colored.
2. Repeat 1, using a rotary egg beater. A small rotary beater will be necessary if only 1 egg yolk is beaten.
3. Add ½ t. melted fat to an egg white. Beat with a rotary beater.
4. Add 1 t. water to an egg white. Beat with a rotary beater.

FOAMING POWER OF EGG WHITE

Experiment	Egg white			Size of air cells	Use
	Original volume	Whipped volume	Times increase		
1. Wire whip					
2. Rotary beater					
3. Fat added, rotary					
4. Water added, rotary					

What is the measure of one average-sized egg yolk? How much is it increased by beating?

Prepare fluffy and white sauce omelets.

STANDARD PRODUCT

Product	Appearance	Texture	Flavor
Fluffy omelet			
White sauce omelet			

Prepare sponge cake.

STANDARD PRODUCT

Product	Appearance	Texture	Flavor
Sponge cake			

H. *Eggs as a thickening agent.*

Use proportions of materials listed below for various experiments. Cook the egg mixtures in double boiler with constant stirring using cold water in lower part at the beginning; gradually heat until mixture reaches a temperature of 82°C. In experiment 7 cook until mixture thickens. The water should not boil except in experiment 6. At desired temperature turn mixture out into a bowl to cool.

Compare thickening power of whole egg, egg yolk, egg white, and flour. Observe temperature at which coagulation begins, effect of presence of salts and rate of cooking.

1. 18 gm. whole egg and 120 ml. distilled water.
2. 18 gm. whole egg, 120 ml. distilled water and ⅛ t. calcium lactate.
3. 18 gm. whole egg and 120 ml. milk.
4. 18 gm. egg white and 120 ml. milk.
5. 18 gm. egg yolk and 120 ml. milk.
6. 18 gm. whole egg and 120 ml. milk. Cook over boiling water.
7. 1 tb. flour and 120 ml. milk.

THICKENING POWER OF EGGS

Experiment	Coagulation	Temperature of coagulation
1. Whole egg, distilled water		
2. Whole egg, distilled water, calcium lactate		
3. Whole egg, milk		
4. Egg white, milk		
5. Egg yolk, milk		
6. Whole egg, milk, cooked rapidly		
7. 1 tb. flour, milk		

I. *Prepare stirred custard.*

Using the following proportions, add scalded milk to lightly beaten egg, then sugar and salt and cook over hot water until desired consistency is reached. Cool, add vanilla. Note variations in color, consistency, and flavor.

1. 1 egg, 1 c. milk, 2 tb. sugar, f. g. salt, ¼ t. vanilla.
2. Repeat 1 substituting 2 egg yolks for whole egg.

VARIATIONS OF EGG IN STIRRED CUSTARD

Experiment	Color	Consistency	Flavor
1. Whole egg			
2. Egg yolk			

J. *Prepare baked custards.*

Using ½ the following proportions, add scalded milk to beaten egg. Add sugar, salt and vanilla. Strain and pour into a custard cup. Set cups in pan of hot water and bak in moderate (177°C. 350°F.) oven. Note variations in color, consistency, flavor, an length of cooking time.

1. ½ egg (24 gm.), 1 c. milk, 2 tb. sugar, f. g. salt, ¼ t. vanilla.
2. 1 egg (48 gm.), 1 c. milk, 2 tb. sugar, f. g. salt, ¼ t. vanilla.
3. 1½ eggs (72 gm.), 1 c. milk, 2 tb. sugar, f. g. salt, ¼ t. vanilla.
4. 2 eggs (96 gm.), 1 c. milk, 2 tb. sugar, f. g. salt, ¼ t. vanilla.
5. 1 egg (48 gm.), 1 c. milk, 1 tb. sugar, f. g. salt, ¼ t. vanilla.
6. 1 egg (48 gm.), 1 c. milk, 4 tb. sugar, f. g. salt, ¼ t. vanilla.
7. 1 egg (48 gm.), 1 c. *cold* milk, 2 tb. sugar, f. g. salt, ¼ t. vanilla.

VARIATIONS IN BAKED CUSTARD

Experiment	Color	Consistency (ability to mold)	Flavor	Time of cookin
1. Decreased egg				
2. Standard amount egg				
3. Slightly increased egg				
4. Greatly increased egg				
5. Decreased sugar				
6. Increased sugar				
7. Cold milk				

STANDARD PRODUCT

Product	Appearance	Texture	Flavor
Stirred custard			
Baked custard			

1. Why does an old egg float whereas a fresh one sinks in water?
2. Explain why eggs may be preserved in a solution of waterglass.
3. What changes take place in eggs as they age?
4. What is the effect of these changes on their use?
5. Why is it easier to separate the white and yolk of a fresh egg?

6. Is the size of the air space a true indication of the age of an egg? Explain.
7. What property of egg proteins makes it possible to use them as a thickening agent?
8. Explain the difference in the thickening power of the whole egg, white, and yolk.
9. Explain the effect of the following on coagulation of egg proteins:
   a. Rate of heating.
   b. Addition of acid.
   c. Addition of salt.
   d. Addition of sugar.
   e. Long beating.
10. What has happened when a custard curdles? What causes it?
11. Explain the dark ring which sometimes forms around the yolk of a hard-cooked egg.
12. What is the flour equivalent of one egg for thickening?
13. How much egg is necessary to thicken 1 c. liquid for baked and steamed custards? How much egg yolk?
14. Why should a custard be strained before cooking?
15. Why are the eggs beaten only slightly for custards?
16. Upon what does the leavening power of eggs depend?
17. Explain the effect of the following on the leavening power of egg white:
   a. Beating until "dry."
   b. Addition of cream of tartar.
   c. Addition of chocolate.
   d. Aging of an egg, during which time it becomes more alkaline.
   e. Over-mixing.
   f. Rough handling.
   g. Different types of beaters.
   h. Covering with mixture to be blended before folding.
   i. Temperature of egg.
   j. Addition of a small amount of water.
   k. Addition of sugar.
18. What is the baking powder equivalent for leavening of one egg?
19. What type of beater may be used for sponge cakes?
20. Explain why the pans are not oiled when baking sponge cakes.
21. Why should the cakes be put together quickly?
22. What is the effect of the cream of tartar and of lemon juice on egg foams?
23. Account for the low baking temperature for sponge-type cakes.
24. Why is the cake allowed to "hang and stretch" until almost cold?
25. How could you use the egg yolks left over from a white sponge cake?

REFERENCES

Child, A. M., and Niles, K. B. *Food Preparation Studies*. Second Edition. pp. 44–53, 63–71.
Halliday, E. G., and Noble, I. T. *Hows and Whys of Cookery*. Second Edition. Chap. V.
Justin, M. M., Rust, L. O., and Vail, G. E. *Foods*. Revised Edition. pp. 184–204, 337–342.
Lowe, B. *Experimental Cookery*. Second Edition. Chap. X.
MacLeod, A. L., and Nason, E. H. *Chemistry and Cookery*. Second Edition. Chap. XXXVII.
Morgan, A. F., and Hall, I. S. *Experimental Food Study*. Chap. XXII.
Stanley, L., and Cline, J. A. *Foods: Their Selection and Preparation*. Chap. VII.
Sweetman, M. D. *Food Preparation*. Second Edition. Chap. VIII.
Wilmot, J. S., and Batjer, M. Q. *Food for the Family*. pp. 163–176.

MILK

Milk is an opaque fluid containing in true solution lactose and mineral salts. Calcium phosphate and the proteins, casein and albumin, are held in colloidal solution. The fat is suspended in the milk in minute globules. The color pigments are in the fat and whey. The vitamin content of milk varies with the diet of the cow and the treatment of milk when marketed.

Milk is preserved naturally for a short time by the production of lactic acid from the lactose by lactic acid bacteria. As the acidity increases, the growth of the putrefactive bacteria is inhibited and the casein precipitates, carrying with it mineral salts, fat, and sugar. The milk is then said to be clabbered. If mold grows on milk after it has soured, the acidity decreases and then the milk putrefies. It is not usable in this state.

A. *Composition—per cent.**

Protein	Fat	Carbohydrate	Water	Ash
3.5	3.9	4.9	87.0	0.7

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials*. U.S.D.A. Circular 549.

B. *The effect of acid and heat on milk.*

1. The curd. Allow 1 qt. of milk to sour naturally. Divide thick clabber into four equal parts. Treat according to methods given below. Then compare the curds as to texture, flavor, temperature, color, and volume. Record results.
   a. Cut 1 c. of thick sour milk with a knife. Do not heat. Drain curd from whey through cheesecloth. Reserve this material for comparison in C 2.
   b. Boil 1 c. thick sour milk for 3 min. Drain as before.
   c. Heat water in lower part of double boiler to 75°C. Maintain this temperature throughout the experiment. Put sour milk in top of double boiler. Cover and let stand until curd separates from whey. How long a time is required? Note temperature of milk when removed. Drain as before.
   d. To 1 c. thick sour milk add an equal quantity of boiling water. Take temperature. Cover and let stand until curd separates. Drain.

EFFECT OF HEAT ON SOUR MILK—THE CURD

Experiment	Volume	Temperature at draining	Texture	Flavor	Color
a. Sour milk, cold					
b. Sour milk, boiled					
c. Sour milk, double boiler					
d. Sour milk, boiling water					

2. The whey. Pour the drained whey into glass measuring cups. Compare for volume, color and flavor.

EFFECT OF HEAT ON SOUR MILK—THE WHEY

Experiment	Volume	Color	Flavor
a. Sour milk, cold			
b. Sour milk, boiled			
c. Sour milk, double boiler			
d. Sour milk, boiling water			

3. Tests. Test curd for protein. Test whey for protein and reducing sugar. Mark presence of these constituents in blanks below.

Tests of	Protein	Sugar
Curd		
Whey		

C. *The effect of rennin on milk.*

1. Conditions for rennet coagulation. Compare results of following experiments for amount of coagulation, temperature involved, texture, color, and flavor of curd.
   a. Heat ½ c. of fresh milk to 37°C. Add ⅛ rennet tablet which has been dissolved in ½ t. water. Pour into dish and let stand undisturbed in a warm place until thickened.

b. Heat ½ c. milk to boiling and add ⅛ rennet tablet which has been dissolved in ½ t. water. Pour into dish and let stand 15 to 30 min.

c. Boil ½ c. milk. Make up to original volume with distilled water. Cool to 37°C. Add ⅛ rennet tablet which has been dissolved in ½ t. distilled water. Let stand as before.

EFFECT OF RENNIN ON MILK

Experiment	Amount of coagulation	Texture of curd	Color of curd	Flavor of curd
a. Milk heated to 37°C.				
b. Milk boiled				
c. Milk boiled, then cooled				

2. Comparison of junket with sour milk. Use sour milk from B a and junket from C a for this comparison and fill in chart below.

COMPARISON OF JUNKET AND SOUR MILK

Characteristics	Sour milk	Junket
Appearance		
Changes in each		
Cause of change in each		
Reaction with litmus		
Firmness of curd on standing		

Cottage cheese.

STANDARD PRODUCT

Type	Appearance	Texture	Flavor
Sour milk			
Rennet			

D. *Acid and milk combined in cooking.*

Use very fresh milk. After first observation allow experiment to stand in a warm place 30 min. Compare product at this time with the first mixture. Record results.

1. Mix ¼ c. milk and ¼ c. tomato juice.
2. Scald ¼ c. milk, add it slowly with constant stirring to ¼ c. hot tomato juice.
3. Add ¼ c. hot tomato juice to ¼ c. scalding milk. Stir continually.
4. Thicken ¼ c. tomato juice to the consistency of medium white sauce, add it to ¼ c. scalding milk.
5. Thicken ¼ c. tomato juice to the consistency of medium white sauce, mix with ¼ c. cold milk. Heat to serving temperature. (70°C.)
6. Thicken ¼ c. tomato juice to the consistency of medium white sauce, add 1/16 t. soda, stir well, then add slowly to ¼ c. scalding milk.

ACID AND MILK IN COOKING

Experiment	Presence of curd	Size of curd	Flavor	Change on standing
1. Cold milk and cold tomato juice				
2. Scalding milk to hot tomato juice				
3. Hot tomato juice to scalding milk				
4. Thickened tomato juice to scalding milk				
5. Thickened tomato juice to cold milk. Heated to 75°C.				
6. Thickened tomato juice plus soda to hot milk				

Prepare cream of tomato soup.

E. *Formation of scum on milk.*

Heat ¼ c. milk until a scum forms on top. Treat as follows and record results.

1. Note temperature of first scum formation.
2. Remove scum and heat again. Notice if it reforms.
3. Beat with a rotary egg beater until a foam forms. Does the scum appear?

SCUM FORMATION ON MILK

1. Temperature of first formation	
2. Second heating	
3. After beating	

Prepare cocoa and chocolate.

1. How does skimmed milk differ from buttermilk?
2. Is it required by law to pasteurize milk in your state?
3. What is the difference between condensed and evaporated milk?
4. Will cream rise on evaporated milk? Explain.
5. What is the effect of boiling on the different constituents of milk?
6. Account for the change in flavor of heated milk.
7. Why does milk which has been heated until the sugar is caramelized often form a curd?
8. Which would contain more calcium: cottage cheese or rennet-curd cheese? Explain.
9. What is the change in boiled milk which decreases its ability to form a curd with rennet?
10. Why is distilled water used in Experiment C 1 c?
11. What is the object of heating sour milk when making cottage cheese? Why must a high temperature be avoided?
12. Write reactions for curd formation in sour milk and with rennet.
13. What is the function of the flour in the preparation of cream of tomato soup? Would starch be as effective?
14. Why should soda be avoided in the preparation of cream of tomato soups?
15. Why is the tomato juice thickened rather than the milk?
16. What is the scum on the top of heated milk?
17. Why is cocoa difficult to mix with water?
18. Why should cocoa be cooked before combining with milk?
19. What is the objection to long cooking of chocolate?
20. How may the formation of a surface skin be prevented in cocoa and chocolate beverages?
21. Why does chocolate sometimes curd on long cooking?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 54–57, 70–71.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 163–172, 484–487.
LOWE, B. *Experimental Cookery*. Second Edition. Chap. IX.
MORGAN, A. F., and HALL, I. S. *Experimental Food Study*. Chap. XXV.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation* Chap. VIII.

SWEETMAN, M. D. *Food Preparation*. Second Edition. Chap. VII.
WILMOT, J. S., and BATJER, M. Q. *Food for the Family*. pp. 126–141.

CHEESE

Ripened cheese is the curd of milk which has been modified as to texture, composition, and flavor through the growth of micro-organisms. Cheese varies according to the kind of milk from which it is made, the method used to precipitate the casein, and the type of organism used in ripening. Cheeses are classified as

1. Hard—firm enough to be sliced or grated.
2. Semi-hard—firm enough to be sliced, but soft enough to spread.
3. Soft.
   a. Ripened.
   b. Unripened.

There are also on the market blended, processed or pasteurized cheeses which differ somewhat from the standard varieties of cheese.

A. *Composition—per cent.**

	Fat	Protein	Carbohydrate	Water	Ash
Cheddar	32.3	23.9	1.7	39.0	3.1
Roquefort	33.2	21.7	1.4	37.4	6.3
Limburger	32.4	23.5	0.7	38.3	5.1
Cottage	0.8	19.2	4.3	74.0	1.7

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials*. U.S.D.A. Circular 549.

B. *Effect of heat on cheese.*

1. Heat a small piece of American Cheddar cheese in a hot frying pan for some time. Describe the result. Allow to cool and examine again.
2. Heat another small piece in a double boiler over warm water. Compare with 1. What precautions must be taken with cheese cookery? Why?
3. Heat some grated cheese with milk in a test tube held in water. Heat slowly and note temperature at which it blends most successfully. Heat water to boiling and notice the effect on the cheese.

EFFECT OF HEAT ON CONSTITUENTS OF CHEESE

Experiment	Protein	Fat	Water	Temperature
1. High dry heat				
2. Moderate dry heat				
3. Moderate moist heat				

1. Why does some cheese become semi-liquid when heated? Stringy?
2. How does the composition of cheese affect its use for cooking?
3. What does one pay the most for in buying cheese?
4. Why is cheese so perishable?
5. Name a variety of cheese which may be used in each of the following:
   Macaroni and cheese.
   Served with crackers.
   In French dressing.
   In a salad.
   In a souffle.

Prepare cheese dishes.

Cheese souffle
Cheese fondue
Welsh rabbit
Custard
White sauce

STANDARD PRODUCT

Products	Appearance	Texture	Flavor
Cheese souffle			
Cheese fondue			
Welsh rabbit			

1. What may cause a souffle to shrink? To fall?
2. What is the cause of stringy Welsh rabbit?
3. Why is the starch cooked separately from the egg when used as a thickening agent in the same recipe?

REFERENCES

JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 173–182, 205–208, 489–490.
LOWE, B. *Experimental Cookery*. Second Edition. Chap. IX.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. IX.
SWEETMAN, M. D. *Food Preparation*. Second Edition. pp. 222–226.
WILMOT, J. S., and BATJER, M. Q. *Food for the Family*. pp. 145–157.

MEAT

Meat tissue consists of tubelike muscle fibers held together in bundles by connective tissue, which in turn is fastened to the bones by thick strands of connective tissue called tendons. There may be fat cells deposited within the connecting tissue. Within the muscle fibers is a muscle juice, which consists of solutions of mineral salts, vitamins, extractives, pigments, a very small quantity of carbohydrate, and the proteins. The major protein is myosin, which is a globulin. Besides this are myogen, an albumin, and in red meat the conjugated protein hemoglobin, which with the other pigments gives the color to meat. The extractives consist largely of derived proteins and protein decomposition products. The connective tissue contains the two albuminoids, collagen and elastin. The amount of these two proteins varies, the connective tissue from the older and much-used muscles containing more elastin and less collagen.

A. *Composition—per cent* (edible portion).*

	Protein	Fat	Water	Ash
Beef round, medium fat	19.3	13.0	67.0	0.95
Veal round, medium fat	19.5	9.0	70.0	1.0
Lamb leg, medium fat	18.0	17.5	63.7	0.9
Pork, ham, medium fat	15.2	31.0	53.0	0.8

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials*. U.S.D.A. Circular 549.

B. *The structure of meat.*
Compare the various cuts of meat as used in the laboratory. Note gross structure showing the differences in amount and quality of lean, amount and firmness of fat, amount and hardness of bone.
Compare various microscopic studies of both cooked and uncooked meat.

C. *The quality of meat.*
Study quality grades of meat, showing wide variation in conformation, finish and quality of good and poor carcasses. Note federal markings for quality grades. If possible

have meat cutting demonstration to show means of identifying various cuts as well as variations in quality.

D. *The cooking of tender and tough meat.*

1. Tender cuts.

Procure top round steak of high grade or T-bone steak. Divide slice from one muscle, cut ½ in. thick into five equal parts. Cook in frying pans. Compare residue in pans as to amount and concentration of juice. Add to the residue in each pan 1 tb. boiling water, stirring well. Compare the gravies obtained. Record results.

a. Sear one piece on each side rapidly in a very hot pan, and remove.
b. Sear one piece on each side rapidly in a very hot pan, then continue cooking for 10 min.
c. Sear one piece rapidly in a very hot pan, but continue cooking at a lowered temperature for 10 min.
d. Place one piece in a hot pan, heat slowly and cook 12 min. over a moderate fire, turning frequently.
e. Salt a piece well, sear rapidly in a very hot pan, lower temperature and continue cooking for 10 min.

Cooking a Tender Cut of Meat

Experiment	Tenderness	Juiciness	Color	Flavor	Gravy
a. Seared rapidly short time					
b. Seared, cooked high temperature					
c. Seared, cooked low temperature					
d. Constant moderate temperature					
e. Salted, seared low temperature					

2. Less tender cuts.

Use bottom round steak of low grade. Cut into four parts.

a. Scrape one piece with a dull knife, separating the fibers from the connective tissue meshwork. Make the part scraped off into a cake. Sear quickly in a hot pan slightly greased, turning frequently to prevent burning. Lower temperature and cook 10 min. Cook the connective tissue in the same way. Compare the two.
b. Sear one piece rapidly in a hot pan, lower the temperature and cook for 10 min. Compare with results in a.
c. Cook another piece in simmering water until tender. Notice appearance when cooked.

d. Cover a piece of meat with vinegar. Let stand ½ hr. Then sear rapidly in a very hot pan, lower temperature and continue cooking for 10 min.

Cooking a Tough Cut of Meat

Experiment	Texture	Color	Flavor
a1. Tender fiber			
a2. Connective tissue			
b. Seared, cooked, low temperature			
c. Simmered			
d. In acid before cooking			

3. Meat soups.
Choose beef from one of the tough cuts. Use ¼ lb. meat with 1 c. water for each experiment unless otherwise stated. Record temperature of coagulation, temperature of color change. Filter and compare amount of coagulum and the flavor of the clear broths. Test residue and filtrate for protein.

a. Soak meat in cold water 30 min. then strain through cheesecloth into a beaker. Heat this liquid on a water bath until the water boils.
b. Grind the meat, then soak in cold water 30 min. Strain through cheesecloth into a beaker. Heat this liquid on a water bath until the water boils.
c. Grind the meat, sear one-third of it, soak the whole amount in cold water 30 min. Strain through cheesecloth into a beaker. Heat this liquid on a water bath until the water boils.
d. Cut into small pieces ⅛ lb. bone and ⅛ lb. meat from a knuckle of veal or a shin of beef. Add 1 c. water. Simmer for 1 hr., strain. Reduce or increase liquid to ½ c. Keep in the refrigerator until next laboratory period.
e. Using ¼ lb. ground gristly meat, add 1 c. water. Simmer for 1 hr. Strain. Reduce or increase liquid to ½ c. Keep in the refrigerator until next laboratory period.

PREPARATION OF MEAT SOUPS

Experiment	Temperature of coagulation	Temperature of color change	Amount of coagulum	Flavor of stock	Body of stock
a. Meat soaked in cold water					
b. Ground meat, soaked					
c. Ground, seared, soaked					
d. Bone and meat, simmered 1 hr.					
e. Ground, gristly meat, simmered					

Formulate a method for preparing soup stock.

1. How does the structure of a muscle in the tenderloin differ from that of the neck?
2. What constituent of meat causes it to be tough?
3. Give methods by which meat may be made tender.
4. May all cuts of meat be made tender? Explain.
5. What gives flavor to meat? How may the flavor be increased?
6. What do you think of the direction, "Broil the steak until tender"?
7. What effect does salt have on the surface of meat? Explain.
8. Why is part of the meat for soup sometimes seared?
9. Why does soup stock thicken when cooled?
10. Would you choose a veal or a beef knuckle for making chilled bouillon?
11. What constituents are found in bone marrow?
12. Give the method for extraction of the maximum amount of constituents from meat for soup.
13. At what temperature does the coagulation of meat proteins begin?
14. At what temperature does the color change?
15. At what temperature does the contraction of connective tissue take place? What is the effect on the tenderness of the meat?
16. Why is meat cooked at a low temperature after searing?

E. *Prepare tender cuts of meat.*

1. Roasts.

   Place on a rack fat side up. Insert a meat thermometer with bulb in center of muscle. Cook at constant oven temperature of 149 to 177°C. (300 to 350°F.) until the interior of the meat reaches the following temperatures. Note appearance, juiciness and flavor.

Beef—Rare	58°C.
Medium	64°C.
Well done	77°C.
Veal	71°C.
Lamb	75°C.
Pork	83°C.

Using roasts of each type of meat, calculate and compare waste, cooking losses (volatile and dripping) and cost. Record results.

COOKERY OF ROASTS

Roast	A. P. weight	Weight ready for cooking	Losses in cooking		Cooked weight	E. P. weight	Cost per pound	
			Volatile	Dripping			Market	E. P.
Beef								
Veal								
Lamb								
Pork								

2. Steaks and chops.
Use beef, veal, pork, lamb, and cured pork. Compare cooking losses and quality of product by broiling and pan broiling. Compare for appearance, juiciness, and flavor.

Cookery of Steaks and Chops

Steak or chop		A. P. weight	Weight ready for cooking	Losses in cooking		Cooked weight	E. P. weight	Cost per pound	
				Volatile	Dripping			Market	E. P.
Beef:	Oven								
	Pan								
Veal:	Oven								
	Pan								
Fresh pork:	Oven								
	Pan								
Cured pork:	Oven								
	Pan								
Lamb:	Oven								
	Pan								

Standard Product

	Appearance	Texture	Flavor
Roast			
Steak or chops			

1. Define searing, broiling, roasting.
2. What are the objectives in cooking tender cuts of meat?
3. What parts of the animal produce tender cuts?
4. Give the name of the corresponding cut in lamb, veal, and pork of a Porterhouse steak in beef. Of a club steak.
5. What is the difference in a standing, a folded, and a rolled rib roast?
6. Account for the difference in flavor of a standing and a rolled rib roast.
7. What is the interior temperature of a beef roast cooked medium rare?
8. What inside temperature is required for pork roasts? Explain.
9. Account for the difference in shrinkage in veal and beef roasts. Difference in flavor.

10. Account for the rise in temperature of the thermometer after roasts are taken from the oven.
11. Name the factors that will affect the minutes per pound for cooking a beef roast.
12. What is the effect of the insertion of skewers upon the cooking time of meat roasts? Explain.
13. Summarize the chemical changes which take place in the cooking of a tender cut of meat.

Prepare less tender cuts of meat.

Swiss steak.
Plain.
Tomato.
Sour cream.
Stuffed flank steak.
Stew.
Pot roast.
Hamburg steak.
Meat loaf.
Soup stock and bouillon.

STANDARD PRODUCT

	Appearance	Texture	Flavor
Swiss steak			
Stuffed steak			
Stew			
Pot roast			
Hamburg steak			
Meat loaf			
Bouillon			

1. Define Swissing, stewing, braising, pot roasting.
2. What are the objectives in cooking tough cuts of meat?
3. What is the purpose of pounding the meat in Swiss steak? The function of the flour?
4. What is the effect of the acid of the tomatoes and sour cream on the meat?
5. Why is the meat cut into pieces for stew? Why is it seared?
6. Why is a low temperature used after the moisture is added?
7. Distinguish between the purpose in cooking of a pot roast and an oven roast.
8. Why are meat loaf and Hamburg steak cooked as tender cuts of meat?
9. How do soup stock, beef juice, and beef tea differ?
10. Define bouillon and consomme.

11. What are bouillon cubes?
12. What are the objectives in the preparation of soup stock?
13. How may soup be clarified?
14. What is the value of stock soups in the diet?

Prepare left-over meat dishes.

Croquettes.
Shepherd's pie.
Souffle.
Brown hash.

STANDARD PRODUCT

	Appearance	Texture	Flavor
Croquettes			
Shepherd's pie			
Souffle			
Brown hash			

1. What are the two types of left-over meat?
2. How does the type affect its use?
3. Account for the cooking temperature used in left-over meat dishes.
4. What vegetables are good carriers of meat flavor.

Prepare meat specialties.

Heart.
Liver.
Sweetbreads.
Tongue.
Kidney.
Brains.

STANDARD PRODUCT

	Appearance	Texture	Flavor
Heart			
Liver			
Sweetbreads			
Tongue			
Kidney			
Brains			

1. Which of these specialties are tender and which are tough?
2. How are they affected by the age of the animal from which they are taken?
3. In what ways do these specialties contribute to the diet?
4. What is the current cost per pound of each?

REFERENCES

HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. X.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 208–219, 225–236, 502–512.
LOWE, B. *Experimental Cookery*. Second Edition. Chap. VII.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. Chap. XXXVIII.
MORGAN, A. F., and HALL, I. S. *Experimental Food Study*. Chap. XXI.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XIII.

POULTRY

Poultry when mature resemble lean beef in composition. They are classified for cookery as tough or tender, according to the age of the bird. The very young birds, called broilers, may be broiled; slightly older ones, fried or roasted. As the birds become mature, they develop more connective tissue, and the method of cooking must be changed to include moist heat at some time during the cooking period. The white and dark meat of the fowl differ in composition, the dark meat containing less water, more fat, extractives, and collagen than the white.

A. *Composition—per cent (edible portion).**

	Protein	Fat	Water	Ash
Chicken:				
Broilers	20.2	7.2	71.2	1.1
Fryers	20.0	11.0	67.6	1.0
Roasters	20.2	12.6	66.0	1.0
Hens and cocks	18.0	25.0	55.9	1.1
Capons	21.4	21.2	56.6	1.2
Turkey—medium fat	20.1	20.2	58.3	1.0

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials.* U.S.D.A. Circular 549.

B. *Roasting poultry.*

Select two young roasting chickens. Weigh before and after dressing. Place on a rack breast side down. Roast according to following directions, then weigh chickens and drippings. Record results.

1. Add 1 c. of water, cover, and cook in an oven at 149°C. (300°F.). Baste and turn chicken at half-hour intervals. Cook until the temperature of the thickest muscle (thigh or breast) is 85°C. Weigh chicken and drippings.
2. Roast uncovered, and without water at 149°C. (300°F.). Baste and turn at half-hour intervals. Roast until the temperature of the thickest muscle (thigh or breast) is 85°C. Weigh chicken and drippings.

COOKERY OF ROAST CHICKEN

Experiment	Market weight	Weight ready for cooking	Losses in cooking		Cooked weight	E. P. weight	Cost per pound	
			Volatile	Dripping			Market	E. P.
1. With water, covered								
2. Without water, uncovered								

Prepare poultry.

Broiled.

Fried.

Flour dipped—pan fried.

Batter dipped—deep-fat fried.

Roasted.

Fricasseed.

STANDARD PRODUCT

Chicken	Appearance	Texture	Flavor
Broiled			
Fried			
Roasted			
Fricasseed			

1. Define trussing, fowl, capon, chicken, giblets.
2. What type of fat distribution is there in milk-fed poultry? In corn-fed?
3. When should poultry be used after killing? Explain.
4. What kind of poultry is the most economical to buy, from the standpoint of losses in cooking?
5. Define fricasseeing.

REFERENCES

JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 220, 236–237, 497–502.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 243–250.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XV.

FISH AND SHELLFISH

Fish are divided into two groups according to their fat content. If the fat is secreted in the liver, the flesh is lean and white. If the fat is distributed throughout, the flesh is oily and generally colored. The lean fish include cod, haddock, flounder, perch, bluefish, bass, and others. The fat fish include mackerel, salmon, shad, herring, swordfish, and others. Halibut is intermediate in fat content. Fish contain very little connective tissue and therefore are cooked as tender meat. The flavor of fish flesh, while usually distinctive, is mild.

Shell fish are divided into two classes: the mollusks, such as oysters, clams, and scallops, that have a soft, unsegmented body, protected by a shell; the crustaceans, including lobsters, crabs, and shrimp, that have a segmented, crust-like shell.

A. *Composition—per cent (edible portion).**

	Protein	Fat	Carbohydrates	Water	Ash
Salmon, Atlantic.....	22.5	13.4	0	63.6	1.4
White fish.....	22.9	6.5	0	69.8	1.6
Oysters.....	9.8	2.0	5.9	80.3	2.0
Lobsters.....	16.2	1.9	0.5	79.2	2.2

* C. Chatfield and G. Adams. *Proximate Composition of American Food Materials*. U.S.D.A. Circular 549.

Prepare fresh fish and shell fish.

Baked.
Fillets.
Steaks.
Shrimps.
Scallops.
Oysters.

STANDARD PRODUCT

Product	Appearance	Texture	Flavor
Baked fish			
Fillets			
Steaks			
Shrimp			
Scallops			
Oysters			

1. Name five white fish commonly used.
2. Name five oily fish commonly used.
3. Why is fish served with tart sauces?
4. Why is a plank desirable for baking a fish?
5. Why is fish sometimes placed in a cheesecloth bag when simmering in water? Why simmer?
6. What is the value of using parchment paper in fish cookery?
7. Why are fish frozen for marketing, rather than ripened like beef?
8. Why are salt-water fish particularly valuable in the diet in some localities?
9. Distinguish between steaks, fillets.
10. What frozen fish are now available in most markets?
11. Compare the use in cooking of fresh fish and frozen fish.
12. Should frozen fish be thawed before cooking?

Prepare canned fish.

Loaf.
Timbales.
Balls.
Creamed.
Souffle.
Chowder.

STANDARD PRODUCT

Product	Appearance	Texture	Flavor
Loaf			
Timbale			
Balls			
Creamed			
Souffle			
Chowder			

1. What grade of salmon would you select for fish loaf? Explain.
2. What cooking temperature should be used in the preparation of fish dishes?
3. How does canned fish compare in food value with fresh or frozen fish?

REFERENCES

JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 220–224, 237–239, 512–515.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XVI.
WILMOT, J. S., and BATJER, M. Q. *Food for the Family*. Unit 13.

GELATIN

Collagen, which is one of the proteins found in the connective tissue of animals, may be hydrolyzed to gelatin. The connective tissue used as a source of gelatin is generally from the cartilage, bones, and skins of animals that have been approved as food. The hydrolysis is brought about under pressure, and the resulting product is purified to obtain the gelatin. The fact that gelatin can be dispersed in hot water and then forms a gel when cooled makes it valuable in food preparation.

A. *The properties of gelatin.*
   1. Forms of gelatin.
      a. Powdered.
      b. Granulated.
      c. Shredded.
      d. Sheet.
   2. Solubility.
      a. Soak ¼ t. in cold water for 3 min. Add 2 tb. boiling water, stirring until gelatin is entirely dispersed. Chill in an ice and salt mixture.
      b. Repeat a, but use boiling water for soaking. Compare with a for ease of dispersion.

c. Repeat a, but boil 5 min., replacing the water lost by evaporation. Compare odor, flavor, and stiffness of gel with a.

PROPERTIES OF GELATIN

Experiment	Solubility	Stiffness	Color	Flavor	Odor
a. Soaked, cold water					
b. Soaked, boiling water					
c. Boiled 5 min.					

B. *Compare lemon jellies made from commercial gelatins.*

1. Make 1 c. lemon jelly from different brands of granulated, acidulated, and prepared gelatins. Compare for flavor, ease of preparation, and cost. Record results.
   a. Plain granulated gelatin. Prepare 1 c. jelly using ½ recipe on package.
   b. Acidulated gelatin. Prepare 1 c. jelly using ½ recipe on package.
   c. Prepared gelatin. Prepare 1 c. jelly using as many varieties as desirable.

COMPARISON COMMERCIAL GELATINS

Experiment	Brand	Convenience	Flavor	Cost per pint		
				Sugar	Acid	Gelatin
a. Plain						
b. Acidulated						
c. Prepared	a					
	b					

C. *Compare basic fruit jelly as used for various gelatin desserts.*

1. Make 2 c. orange jelly. Divide into four parts. Treat as follows:
   a. Pour one part into mold and chill without further treatment.
   b. Chill until slightly thickened then beat until it hangs from the beater. Pour into a mold and chill until firm.
   c. Chill until slightly thickened. Add 1 egg white beaten stiff and beat rapidly until mixture hangs from the beater. Keep mixture chilled while beating. Pour into a mold and chill until firm.

d. Chill until slightly thickened. Beat until it hangs from the beater, then fold in ½ c. whipped cream. Pour into a mold and chill until firm.

STANDARD PRODUCT

	Appearance	Texture	Flavor
a. Plain			
b. Whip			
c. Sponge			
d. Bavarian			

1. What kind of a system does gelatin form in water?
2. What two thickening agents does it resemble in its property of gel formation?
3. Why is it possible to incorporate air into gelatin?
4. How much does gelatin increase in bulk when beaten?
5. What is the effect of fresh pineapple on the jelling property of gelatin? Explain.
6. When are solids added to plain gelatin? Explain.
7. Why do some gelatins act more quickly than others?

REFERENCES

JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 241–247.
LOWE, B. *Experimental Cookery*. Second Edition. Chap. VI.
MORGAN, A. F., and HALL, I. S. *Experimental Food Study*. Chap. XIX.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XIV.

BATTERS AND DOUGHS

Batters and doughs are mixtures of flour and liquid which are modified by the addition of varying amounts of sugar, eggs, fat, and leavening, forming complicated colloid systems. The batters and doughs have been classified on the basis of the proportion of liquid to flour and are recognized by their consistency.

Batters.

Pour—pours in a steady stream.

Drop—breaks into drops when poured.

Doughs.

Soft—soft to the touch.

Stiff—firm to the touch.

The varied batter and dough recipes found in many cook books are modifications of basic formulas. A knowledge of proportions and the factors affecting change in proportions of ingredients is essential.

FLOUR

Types of wheat flours.

1. Whole wheat or graham flour, made from the entire wheat kernel. The wheat from which it is made may be hard or soft or a blend of the two.
2. White flour.
   a. Hard wheat flour, used for bread flour or in making blended flour, such as all-purpose flour.
   b. Soft wheat flour, used for cake and pastry flours or in blending flour, such as all-purpose flour.

A. *Examine and compare flours for:*

1. Color.
2. Packing in hand when pressed.
3. Texture.

PROPERTIES OF FLOURS

Flour	Color	Packing	Texture
Hard wheat or bread flour			
Blended or all-purpose flour			
Soft wheat or cake flour			
Whole wheat flour			
Corn meal			

B. *Properties of flour; forming gluten from flour.*

Use various types of flour previously tested.

Bread flour.
All-purpose flour.
Cake flour.
Whole wheat flour.
Corn meal.

Mix 30 gm. of the flours with enough water measured in a cylinder to make a stiff dough. The dough should not be sticky. Let the dough stand 5 min., knead thoroughly observing the increasing elasticity of the dough. Wash the ball of dough in an excess of cold water until the starch has been completely washed out leaving a gray-colored sticky mass of gluten. Be careful not to lose any of the gluten in washing. Weigh gluten and take its volume by water displacement. Reserve for later baking. Use corn meal for comparison with above flours.

1. Absorption of liquid. From the measurement of water needed to make a dough from 30 gm. flour calculate the amount of water to make a similar dough from 1 c. flour. Record.
2. Effect of kneading. How does the dough change in character during the kneading process?
3. Moist gluten. From the weight of the moist gluten ball calculate the per cent of moist gluten. Record weight, per cent of moist gluten and volume.
4. Composition of gluten. Test a lump of gluten by the xanthoproteic test.

FORMATION OF GLUTEN

Flour	Flour weight gm.	Water volume ml.	Water absorbed by 1c. flour ml.	Moist gluten weight gm.	Moist gluten per cent	Moist gluten volume ml.
Bread flour						
All-purpose flour						
Cake flour						
Whole wheat flour						
Corn meal						

5. Effect of heat on gluten. Bake gluten balls from each type of flour in an oven at 240°C. (465°F.). Bake another sample of each in an oven at 160°C. (320°F.). Compare for differences in color, texture and relative volume after baking. Record results.

BAKED GLUTEN BALLS

Source of gluten	Relative volume after baking		Texture	
	160°C.	240°C.	160°C.	240°C.
Bread flour				
All-purpose flour				
Cake flour				
Whole wheat flour				
Corn meal				

6. Effect of other substances on gluten. Using all-purpose flour add other substances to flour before adding water. Follow through directions in 1 and 2 above. What is the effect of these substances on gluten?
   a. Sugar. Mix 40 gm. sugar with flour.
   b. Egg. Mix 15 gm. egg with flour.
   c. Fat. Mix 10 gm. fat with flour.

C. *Measuring flour.*

1. Fill a cup with unsifted flour.
2. Sift and refill the cup, being careful not to pack the flour.
3. Measure the amount of flour left.
4. Repeat until further sifting gives no flour left over. Record results.

Experiment	Amount flour left
1. Sifted once	
2. Sifted twice	
3. Sifted three times	

1. Distinguish between bread and cake flour; strong and weak flour.
2. Why is wheat flour used in making bread?
3. Does any other grain flour have properties similar to wheat for this purpose?
4. Why does the amount of liquid vary in a recipe when one type of flour is substituted for another?
5. Can you make a light muffin from corn meal alone?
6. Criticize the directions, "Sift the flour four times."
7. When a recipe calls for a given amount of flour will you measure it before or after sifting? Why?
8. Define gluten and explain how it is formed.
9. Name the qualities of gluten that make it desirable in batters and doughs.
10. What is the effect of the addition of egg, of sugar, and of fat on gluten formation?

REFERENCES

American Home Economics Association. *Terminology Used in Food Preparation*. pp. 10–12.
Halliday, E. G., and Noble, I. T. *Hows and Whys of Cooking*. Second Edition. pp. 40–43.
Justin, M. M., Rust, L. O., and Vail, G. E. *Foods*. Revised Edition. pp. 84–89, 464–465.
Lowe, B. *Experimental Cookery*. Second Edition. pp. 391-402.
MacLeod, A. L., and Nason, E. H. *Chemistry and Cookery*. Second Edition. Chap. XXXV.
Stanley, L., and Cline, J. A. *Foods: Their Selection and Preparation*. Chap. XIX.

LEAVENING AGENTS

Leavening agents are used in batters and doughs to give them lightness and a porous texture. They may be classified as:

Physical.
  Steam.
  Air.
Chemical:
  Carbonate and an acid which produce carbon dioxide.
Biological.
  Yeast—producing carbon dioxide.
  Bacteria—producing gas.

A. *Physical leavening agents.*

1. Steam

a. Pour batter. Popovers.

Liquid	Flour	Eggs	Fat	Salt
1 c. milk	1 c. hard wheat	2	1 tb.	¼ t.

Melt fat, then place all the ingredients in a bowl and beat with a rotary egg beater until the batter is smooth. Place mixture in two deep oiled custard cups filling ⅓ full. Bake at 219°C. (425°F.) for 25 min., then at 177°C. (350°F.) for 15 min. and hold 10 min. in an open oven.

1. Use ¼ above recipe, following standard method given above.
2. Use ¼ above recipe, substituting an equal weight of soft wheat flour.
3. Use ¼ above recipe, omitting the egg.

Compare results and record.

Experiment	Volume	Appearance	Texture
1. Standard recipe			
2. Substitute soft wheat flour			
3. Omit egg			

B. *Chemical leavening agents.*

1. Soda and acid.

a. Mix a small amount of the following substances with distilled water. Test each with red and blue litmus paper which has been moistened with distilled water. Record results.

Testing Materials	Acid	Base	Neutral
Soda			
Cream of tartar			
Sodium aluminum sulfate			
Calcium acid phosphate			
Tartaric acid			
Molasses			
Sweet milk			
Sour milk			
Vinegar			
Brown sugar			
Chocolate			
Honey			

b. Put stated amounts of the following substances in 400-ml. beakers. Add ¼ t. soda to each. Compare the evolution of gas for rapidity and amount. Record comparisons.

Testing materials	Rapidity	Amount
1 t. cream of tartar in ½ c. cold water		
1 t. cream of tartar in ½ c. hot water		
½ c. molasses		
½ c. sour milk		
½ c. vinegar		
½ c. cold water		
½ c. hot water		

C. *Baking powders.*

1. Acids

a. Place ¼ t. of powdered tartaric acid in a beaker, add 100 ml. cold distilled water, stir, and observe solubility. If the acid does not dissolve readily place ¼ t. in another beaker and add 100 ml. boiling water. Add ⅛ t. soda and note the rapidity of gas evolution.

b. Repeat a, using cream of tartar.

c. Repeat a, using calcium acid phosphate.

d. Repeat a, using sodium aluminum sulfate.

Heat but do not boil the insoluble acids to see if there is any reaction with soda. Time the reaction. Record results in minutes. From these results classify the baking powders as slow-acting and rapid-acting.

PROPERTIES OF BAKING POWDER ACIDS

Experiment	Solubility		Evolution of gas	
	Cold	Hot	Cold	Hot
a. Tartaric acid				
b. Cream of tartar				
c. Calcium acid phosphate				
d. Sodium aluminun sulfate				

2. End products.

a. Add 50 ml. distilled water to ½ t. of each type of baking powder. Note the time of reaction when cold. Heat, but do not boil, and note time of reaction. When no more gas is formed test residue with litmus and for starch. Taste the residue. Record the results.

If the baking powder contains egg white note the effect on the viscosity of the fluid in the beaker.

BAKING POWDER REACTIONS

Type	Time of reaction		Starch	Egg white	Litmus
	Cold	Hot			
Tartrate					
Phosphate					
Sulfate-phosphate					

3. Write the equations for the reaction of baking powders.

   a. Tartrate: _____

   _____

   b. Phosphate: _____

   _____

   c. Sulfate-phosphate: _____

   _____

4. Baking powders in general use.
   Supply the following information about commercial baking powders.
   a. Name of brand.
   b. Acid-reacting ingredients.
   c. Type of action to be expected.
   d. Price per pound.
   e. Proportions suggested for use on the package with 1 c. of flour.

COMMERCIAL BAKING POWDERS

Brands	Acid reacting ingredients	Type of action	Price per pound	Amount to 1c. flour

1. Explain two methods by which air may be introduced into a flour mixture.
2. What temperature is necessary for baking when steam is used as a leavening agent? Explain.
3. In what type of batters can steam be used as a leavening agent? Explain.
4. Can you make a popover from flour, liquid, fat, and salt?
5. Does beating a popover batter injure its texture?
6. Give the reaction of soda with hot water.
7. Why is soda not used alone as a leavening agent?
8. How is the soda introduced when it is used with sour milk in a recipe as a leavening agent? Explain.
9. What are the acids used in baking powders?
10. What determines the rapidity with which baking powders react?
11. What is the function of starch in baking powder? Of egg white?
12. In what kind of climate would baking powder deteriorate most quickly?
13. Give the bases upon which you would judge a baking powder for desirability.
14. What causes the wide range in the price of baking powders?
15. Why is the baking of a popover continued after the steam has expanded the batter forming a shell?
16. What is the baking powder equivalent of 1 t. soda?
17. What effect would high altitude have on the expansion of carbon dioxide?
18. How would you apply this in making baked products in high altitudes?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 75–79, 81–83, 88–93.
HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. II.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 304–312.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 447–456.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. Chap. XV.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XXI.
SWEETMAN, M. D. *Food Preparation*. pp. 398–408.

QUICK BREADS

BATTERS

Pour Batters

A. *Prepare popovers.*

Standard Product

Appearance	Texture	Flavor

B. *Prepare timbales and rosettes.*

Use ½ recipe.

Liquid	Flour	Eggs	Salt
1 c. milk	1 c. hard wheat	2	¼ t.

Combine as for popovers.

Standard Product

Appearance	Texture	Flavor

C. *Prepare griddle cakes.*

Use ½ recipe

Liquid	Flour	Sugar	Eggs	Fat	Leavening agent	Salt
1 c. milk	1⅓ c.	2 tb.	1	2 tb.	2 t. b.p.	½ t.
1 c. sour milk	1–1¼ c.	2 tb.	1	2 tb.	½ t. soda	1½ t.

Combine and sift together dry ingredients. Beat eggs thoroughly, add melted fat and liquid. Add the dry ingredients to liquids all at once. Stir 50 strokes. Preheat but do not oil the griddle for baking. Compare products.

STANDARD PRODUCT

Type	Appearance	Texture	Flavor
Sweet milk			
Sour milk			

D. *Prepare waffles.*
Use ½ recipe.

Liquid	Flour	Eggs	Fat	Baking powder	Salt
1 c. milk	1½ c.	2	4 tb.	2 t.	½ t.

Combine as griddle cakes using following variations.

1. Beat eggs without separation.
2. Separate eggs, combine yolk with other liquids. Stir in beaten white with last 15 to 20 strokes.

STANDARD PRODUCT

Method	Appearance	Texture	Flavor
Egg beaten together			
Separated egg			

DROP BATTERS

A. *Prepare muffins.*
Use ¼ recipe.

Liquid	Flour	Eggs	Fat	Sugar	Baking powder	Salt
1 c. milk	2 c.	1	3 tb.	2 tb.	3 t.	½ t.

1. The effect of the amount of mixing on muffins.
Combine well-beaten egg, milk, and melted fat. Sift dry ingredients together. Turn the dry ingredients into the liquid ones all at one time and immediately combine the two by stirring until the dry ingredients are just moistened.

a. Remove one half to muffin tins.
b. Continue stirring the remainder until the batter is smooth. Place in muffin tins. Bake both sets of muffins in a hot oven 219°C. (425° F.) 15 to 20 min. Compare the two products.

EFFECT OF AMOUNT OF MIXING ON MUFFINS

Experiment	Volume	Shape	Crust	Texture
a. Short stirring				
b. Long stirring				

2. The effect of various ingredients on character of muffins.
Use muffin formula in preceding experiment, but double the quantity in turn of:
a. Milk.
b. Flour.
c. Eggs.
d. Fat.
e. Sugar.
f. Baking powder.
g. Fat and sugar.
Mix until ingredients are just dampened. Compare batter with that in preceding experiment. Then continue stirring until batter is smooth. Bake in a hot oven 219°C. (425°F.) 15 to 20 min. Compare and record results.

EFFECT OF INCREASED INGREDIENTS ON MUFFINS

Double quantity	Volume	Shape	Crust	Texture	Color
a. Milk					
b. Flour					
c. Eggs					
d. Fat					
e. Sugar					
f. Baking powder					
g. Fat and sugar					

STANDARD PRODUCT

Appearance	Texture	Flavor

Prepare muffin variations.

Whole wheat
Blueberry
Corn meal
Date
Bacon
Peanut butter
Cheese
Nut

STANDARD PRODUCT

Variation	Appearance	Texture	Flavor

Prepare quick loaf breads.

STANDARD PRODUCT

Type bread	Appearance	Texture	Flavor

Prepare gingerbread.

STANDARD PRODUCT

Appearance	Texture	Flavor

Prepare cream puffs.

STANDARD PRODUCT

Appearance	Texture	Flavor

1. What determines whether a griddle cake will be thick and breadlike or thin and crisp in texture?
2. Why is less flour used in a recipe if sour milk is substituted for sweet milk?
3. What causes a griddle cake and waffle to brown?
4. How does the amount of egg affect the amount of baking powder used?
5. Why is there a difference in the method of introduction of eggs in griddle cakes and waffles?
6. Explain how a crisp waffle is obtained. A soft waffle.

7. What is the effect of over-mixing on the texture of a muffin?
8. Explain the formation of "tunnels" in a muffin.
9. Account for the difference in the amount of baking powder in the muffin and waffle recipes.
10. Classify the following products in the batter series from your observations of the consistency of the batter: popover, griddle cakes, waffles, and muffins.
11. Explain the difference in the way a muffin batter drops from the spoon with little and with much mixing.
12. Account for the difference in the amount of mixing of muffins and gingerbread.
13. What is the color of gingerbread made with baking powder? With soda? Explain.
14. If excess soda is used in gingerbread, when should it be added in the mixing process? Explain.
15. Why does gingerbread made with excess of soda and baked in a loaf pan often fall in the center?
16. Account for the difference in the preparation of popovers and cream puffs.

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 75–80, 88–93.
HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. III.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 312–328.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 456–471.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. Chap. XLV.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XVIII.
U. S. D. A. Farmers' Bulletin 1775. *Homemade Bread, Cake and Pastry*.

B. *Prepare foundation cake.*
Use ⅓ recipe.

Liquid	Flour	Eggs	Fat	Sugar	Baking powder	Salt	Flavoring
1 c. milk	3 c. (cake)	3	½ c.	1½ c.	4 t.	½ t.	1 t.

1. The effect of the method of mixing.
   a. Conventional method. Cream the fat, add the sugar gradually, and beat until the mixture is spongy. Add the salt, flavoring and well-beaten eggs. Beat vigorously. Add alternately the sifted dry ingredients and milk. Beat 1 min. after all the ingredients are added. Bake in a moderate oven 185°C. (365°F.) for 25 min.
   b. Repeat a, separating yolks and whites of eggs. Add yolks to creamed butter and sugar mixture. Stir well-beaten whites in with last 30 to 40 strokes. Bake as in a.
   c. Muffin method. Mix and sift dry ingredients. Beat eggs thoroughly, add milk, melted fat, and flavoring. Combine liquid and dry ingredients and beat same amount as in method a. Bake as in a.
   d. Mechanical method. Follow directions accompanying mixer. Bake as in a.
2. The effect of the type of flour on cake.
   a. Repeat 1a, substituting an equal weight of hard wheat flour. Bake as in 1a.
   b. Repeat 1a, substituting an equal weight of all-purpose flour. Bake as in 1a.

Compare cakes for volume, shape, color, and tenderness of crust, fineness of cells, thickness of cell walls, velvetiness of texture. Record results.

EFFECT OF VARIATIONS IN METHOD AND TYPE OF FLOUR ON CAKE

Experiment	Shape	Volume	Crust	Color of crumb	Texture
1. a. Conventional					
b. Conventional, eggs separated					
c. Muffin					
d. Mechanical mixer					
2. a. Hard wheat flour					
b. All-purpose flour					

STANDARD PRODUCT

Appearance	Texture	Flavor

Prepare cake variations.

Chocolate.
Devil's food.
Spice.
White.

STANDARD PRODUCT

Variation	Appearance	Texture	Flavor

1. Beating is one of the essential points of manipulation in cake-making. Explain.
2. Why does beating not form tunnels in cake as it does in muffins?
3. Why do the time of beating and the temperature of the oven differ in cake-making when different types of baking powder are used?
4. Explain the reasons for using soft wheat flour, plastic fat, fine sugar, and medium-sized eggs in cake-making.
5. Why is a butter cake made by the conventional method lighter in color than those made by the methods in which the butter is not creamed?
6. Do you use a hotter oven for a loaf or a layer cake? Explain.
7. Summarize the effects on cake of: too much sugar, too much flour, bread flour, over-beating, too high oven temperature, excess fat, too hot fat (in muffin method), too slow baking.
8. In what respects do white and plain cakes differ? Explain.
9. How may a red chocolate or devil's food cake be obtained?
10. What effect does the production of a red cake have on the texture of the cake?

REFERENCES

HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. IV.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 343–350.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 473–517.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XX.
U. S. D. A. Farmers' Bulletin 1775. *Homemade Bread, Cake and Pastry*.

DOUGHS

SOFT DOUGHS

A. *Prepare biscuits*

Liquid	Flour	Fat	Baking powder	Salt
Scant $\frac{2}{3}$ c. milk	2 c. (all-purpose)	$\frac{1}{3}$ c.	3 t.	$\frac{1}{2}$ t.

1. The effect of varied manipulation.
   Sift the dry ingredients together and cut in the fat with a pastry blender. Avoid over-blending; some of the fat-flour particles should be left about the size of peas. Make a well in the mixture and add the milk, slowly stirring from the center until a soft dough is formed.
   a. Drop one-fourth of the dough by spoonfuls on a greased baking sheet.
   b. Shape one-fourth of the dough into a ball, roll ½ in. thick and cut.
   c. Place the remainder of the dough on a lightly floured board. Knead lightly about 18 strokes. Roll ½ in. thick and cut.
      (1) Bake half of these biscuits at once.
      (2) Bake the other half after standing covered with a damp cloth for half an hour.
   d. Combine scraps of dough. Knead for 2 min. Roll ½ in. thick and cut.
   Bake in a hot oven 232°C. (450°F.) for about 15 min. Compare products and record results.

Effect of Varied Manipulation on Biscuits

Experiment	Volume	Shape	Crust	Texture
a. Drop				
b. Cut without kneading				
c1. Kneaded, baked at once				
c2. Kneaded, held 30 min.				
d. Over-kneaded				

Standard Product

Appearance	Texture	Flavor

1. Why is the fat added before the liquid in a biscuit?
2. What may be the cause of brown spots in biscuits?
3. What will be the effect on the color, flavor, and texture of biscuits if excess soda is used in sour milk biscuits?
4. If sour cream is used in biscuits what other ingredient is decreased?
5. Why do milk biscuits brown more readily than water biscuits?

6. What is the effect of under-mixing a biscuit? Over-mixing?
7. Is it possible to mix biscuits some time before baking? Griddle cakes? Popovers?
8. Account for the difference in amount of baking powder in biscuits and waffles.
9. If 1 c. of sour milk and ½ t. soda were used in biscuits, how much baking powder would be used? Explain.

REFERENCES

HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. VI.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 312–328.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 471–473.
U. S. D. A. Farmers' Bulletin 1775. *Homemade Bread, Cake and Pastry*.

STIFF DOUGHS

A. *The effect of varying ingredients and manipulation in a flour-water dough.*
Record the volume of water required in each of the following experiments. Roll each dough to ⅛ in. in thickness and bake a section in an oven at 232°C. (450°F.). Compare and record results.

1. Effect of fat.
   a. Mix ¼ c. all-purpose flour with just enough water to make a stiff dough.
   b. Cut 1 tb. solid fat into ¼ c. flour and add just enough water to make a stiff dough.
   c. Mix 1 tb. oil into ¼ c. flour and add just enough water to make a stiff dough.
2. Effect of excess water on dough.
   a. Repeat 1b, using twice the amount of water found necessary.
3. Effect of manipulation on dough.
   Cut 2 tb. fat into ½ c. flour. Add just enough water to bind the ingredients, mixing as little and as lightly as possible. Divide dough into two parts.
   a. Roll to ⅛ in. in thickness and bake a section at 232°C. (450°F.).
   b. Knead for 2 min., then complete as in a.

VARYING INGREDIENTS AND MANIPULATION OF STIFF DOUGH

Experiment	Appearance	Flakiness	Tenderness	Water volume
1. a. Flour and water				
b. Solid fat added				
c. Liquid fat added				
2. a. Excess water				
3. a. Mixed lightly				
b. Knead 2 min.				

B. *Prepare pastry.*

Flour	Fat	Water	Salt
$\frac{3}{4}$ c. (all-purpose)	3 tb.	2 tb. (ice)	$\frac{1}{4}$ t.

1. The effect of treatment of pastry shell in baking.
   Mix the flour and salt, and cut the fat in with a pastry blender. Allow some particles to remain the size of peas. Sprinkle the ice water over the surface combining each dampened part into a dough, then add more water sparingly until the mixture becomes a stiff dough. Form into a ball and allow to stand 5 min. before rolling. Roll lightly. Arrange for baking according to following directions. Bake in a hot oven 205°C. (400°F.) for 10 min. Compare and record results.
   a. Cover inside of pie pan with crust. Pat the sheet very lightly into the pan to prevent air bubbles remaining underneath. Do not prick.
   b. Cover the inside of pie pan with a crust as in a. Prick surface with a fork.
   c. Cover bottom of inverted pie pan. Prick surface with a fork. When partly done, slip into inside of pan and finish baking.
   d. Cover inside of pie pan with crust as in a. Place another pan of same size on the crust and bake. When partly done take top pan out and finish baking crust.

Experiment	Shapeliness	Color	Texture
a. Inside, no pricking			
b. Inside, pricked			
c. Outside, pricked			
d. Shaped with pan			

Prepare pies.
Custard.
Lemon.
Fruit.

STANDARD PRODUCT

Type pie	Appearance	Texture	Flavor

1. Describe the structure of pastry dough.
2. Why is it important to have the fat finely divided?
3. What is the effect of the addition of too much water?
4. Which will require less water, pastry or bread flour?
5. Why can bread flour be used in pastry with satisfactory results?
6. With which flour is the handling of the dough more important?
7. Why is the selection of the fat important in pastry making?
8. Explain why a plastic fat is desirable for pastry.
9. What is the difference in the texture of a pastry made with oil and a solid fat? Explain.
10. What is the difference in the texture of pastry made by the hot-water method and by cutting in the solid fat?
11. What are the leavening agents in pastry?
12. Upon what does the flakiness of pastry depend? The tenderness?
13. Why may butter toughen pastry when lard does not?
14. Why is a hot oven necessary in baking pastry?
15. Why is the pie filling cooked apart from the shell when starch is used for thickening?
16. Why is meringue browned at a low temperature?
17. What causes bulging of pie crusts? How may it be prevented?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 85–86.
HALLIDAY, E. G., and NOBLE, I. T. *Hows and Whys of Cooking*. Second Edition. Chap. VII.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 351–355.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 562–572.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XXII.
U. S. D. A. Farmers' Bulletin 1775. *Homemade Bread, Cake and Pastry*.

YEAST BREADS

A. *The effect of temperature on the activity of yeast.*

1. Blend 1 yeast cake with 1 pt. water in which 1 t. molasses has been mixed. Treat portions in various ways listed below. After treatment place in fermentation tubes. Keep the first three at room temperature and the fourth in refrigerator, and note results after holding 1 hr. Make a brief statement regarding activity.
   a. Freeze.
   b. Boil.
   c. Heat to lukewarm temperature.
   d. Chill.

EFFECT OF TEMPERATURE ON YEAST ACTIVITY

Treatment	Activity
a. Frozen	
b. Boiled	
c. Heated to lukewarm	
d. Chilled	

2. Make a slide from portion c in previous experiment. Observe yeast plants under the microscope. Draw.

B. *The effect of various food materials upon yeast activity.*

1. Using ⅛ yeast cake for each portion combine with it the food materials listed in the following chart. Put each in a fermentation tube. Keep at lukewarm temperature for 1 hr. Observe and record activity.

EFFECT OF FOOD MATERIALS UPON YEAST ACTIVITY

Yeast	Food	Activity
⅛ cake	Water, ¼ c.	
⅛ cake	Water, ¼ c., flour ½ t.	
⅛ cake	Milk, ¼ c.	
⅛ cake	Milk, ¼ c., flour, ½ t.	
⅛ cake	Potato water, ¼ c.	
⅛ cake	Water, ¼ c., starch, ¼ t.	
⅛ cake	Water, ¼ c., sugar, ½ t.	
⅛ cake	Water, ¼ c., flour, ½ t., salt, ¼ t.	

C. *Prepare white bread.*

Liquid	Flour	Fat	Sugar	Sugar	Yeast
½ c. Scalded milk	1½ c. (all-purpose)	1 t.	1 t.	½ t.	1 cake compressed

Cool rapidly to 38°C. (100°F.) one half the scalded milk to use for softening the yeast. When cool add the yeast. The remainder of the scalded milk may be added while hot to sugar, salt, and fat. Cool the liquids to such a temperature that when mixed with the flour a dough temperature of 28°C. (82°F.) will be obtained. The exact temperature depends upon the temperature of the room and the flour. Add sifted flour to combined liquids and stir until dough leaves container in smooth ball. Turn out on a lightly floured board and knead quickly until it is soft, smooth and elastic. Avoid using too much flour, for as the gluten develops the stickiness disappears.

After kneading, allow to rise keeping the dough temperature 28 to 30°C. When double in bulk, punch down. Do not knead. If hard wheat flour is used let rise a second time; if soft wheat flour is used no second rising period is necessary. If second rising is used punch down. Mold into a loaf and put into bread pan. Let rise until double in bulk. Maintain the dough temperature of 28 to 30°C. by keeping pans in lukewarm water and covered with a clean cloth. Bake in a moderately hot oven 196°C. (385°F.) for first 15 min. for pound loaves. Then lower temperature to 177°C. (350°F.) for remainder of baking. Total baking time 45 min. to 1 hr.

Score bread comparing with a baker's loaf.

Score Card for Yeast Bread*

		Perfect score	Own loaf	Baker's loaf
External characteristics		30		
Shape—well proportioned, evenly rounded top	10			
Crust—uniform browning, except slightly darker on top, about $\frac{1}{8}$ in. deep, crisp, tender, smooth, free from cracks and bulges	10			
Volume—light in weight in proportion to size	10			
Internal characteristics		40		
Texture—tender elastic crumb, free from dryness or doughiness	20			
Grain—fine cells elongated upward, evenly distributed, cell walls thin	10			
Color—characteristic of ingredients used, free from dark streaks	10			
Flavor		30		
A blend of well-baked ingredients, free from undesirable flavor from bacterial action (sourness) or of yeast or other ingredients	30			
Standard product		100		

* U.S.D.A. Farmers' Bulletin 1775. *Homemade Bread, Cake and Pastry.*

Prepare light rolls.

Parkerhouse.

Butterhorn.

Cinnamon.
Pecan.
Cloverleaf.
Hot cross buns.
Dutch apple cake.
Swedish tea ring.

STANDARD PRODUCT

Type of roll	Appearance	Texture	Flavor

1. Explain the effect of freezing, boiling, cold, and warm temperatures upon the growth of yeast.
2. Give optimum temperature for growth of yeast.
3. Explain why yeast will grow in flour solutions, when dextrose is its food. In sucrose solutions.
4. Distinguish between dry and compressed yeast.
5. What is a sponge? Its purpose?
6. What is the purpose of each kneading in bread-making?
7. Explain why good bread which is made from a high-gluten flour is not tough.
8. Describe the structure of a bread dough.
9. Can the gluten be over-developed?
10. What is the result when bread has been over-fermented?
11. What causes the characteristic flavor of white bread?
12. Summarize the chemical changes which may take place in bread during fermentation.
13. Summarize the changes which take place in bread during baking.
14. Point out the steps in bread-making which bear directly on the yeast.
15. What is salt-rising bread?
16. How do a bread and light roll recipe differ? Explain.

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. pp. 82–84, 94–95.
JUSTIN, M. M., RUST, L. O., and VAIL, G. E. *Foods*. Revised Edition. pp. 329–337.
LOWE, B. *Experimental Cookery*. Second Edition. pp. 424–439.
STANLEY, L., and CLINE, J. A. *Foods: Their Selection and Preparation*. Chap. XXIII.
SWEETMAN, M. D. *Food Preparation*. Second Edition. Chap. XIII.
U. S. D. A. Farmers' Bulletin 1775. *Homemade Bread, Cake and Pastry*.

FOOD PRESERVATION

Food spoilage is due to the growth of microorganisms such as bacteria, yeasts and molds, and to enzymes in the food. To preserve foods either the microorganisms and enzymes must be destroyed and the food sealed hermetically, or conditions must be created in the food which will check or retard the growth of the microorganisms and the activity of the enzymes. Preservation will be temporary or permanent depending on whether the microorganisms are destroyed or their growth only checked. Since enzymes are more sensitive to external conditions than microorganisms any method used to destroy microorganisms will render the enzymes inactive. The common methods of preservation are:

A. Change in temperature.
   1. Raising the temperature.
      a. Pasteurization.
      b. Canning.
   2. Lowering the temperature.
      a. Common storage.
      b. Refrigeration.
      c. Freezing.

B. Drying.
   1. Natural.
   2. Dehydration.

C. Use of preservatives.
   1. Sugar.
   2. Salt.
   3. Acid.
   4. Chemical preservatives.

D. Exclusion of air.

SPOILAGE OF FOODS

A. *Conditions favoring or retarding the growth of molds.*
   1. Place a piece of bread in each of two culture dishes. Expose to the air during the class period, then cover and keep both in a dark place at room temperature for two days. Record the results.
      a. Dry bread.
      b. Moistened bread.

2. Place a piece of bread in each of four culture dishes. Expose to the air during the class period, then store.
   a. In a warm place.
   b. In the refrigerator.
   c. In the sunlight.
   d. In a dark, warm place.

Record the results at the end of 2 days and at 1 week.

GROWTH OF MOLD

Experiment	Spoilage in 2 days	Spoilage in 1 week
1. a. Dry bread		
b. Moistened bread		
2. a. Stored in warm place		
b. Stored in refrigerator		
c. Stored in sunlight		
d. Stored in warm, dark place		

B. *Conditions favoring or checking the growth of bacteria.*

1. Sterilize 4 test tubes. Fill each tube half full of uncooked fruit, cut in small pieces, and treat as follows:
   a. Fill with cold water, cork, and seal with paraffin.
   b. Cover with water and boil 3 min. Fill with boiling water, cork, and seal with paraffin.
   c. Repeat b, but do not cork the tube.
   d. Repeat b, but plug with sterile cotton.
2. Repeat 1 using unsterilized tubes. Record results at end of 2 days and 1 week.
3. Fill six test tubes half full of pieces of fruit and cover as follows:
   a. With salt.
   b. With sugar.
   c. With 10 per cent solution of sugar.
   d. With vinegar.
   e. With oil.
   f. With alcohol.

   Record the results at the end of 1 week and 2 weeks.

GROWTH OF BACTERIA

Experiment	Spoilage in 2 days	Spoilage in 1 week
1. Sterile tubes a. Cold water, sealed		
b. Boiled, sealed		
c. Boiled, unsealed		
d. Boiled, closed with cotton		
2. Unsterile tubes a. Cold water, sealed		
b. Boiled, sealed		
c. Boiled, unsealed		
d. Boiled, closed with cotton		

	Spoilage in 1 week	Spoilage in 2 weeks
3. a. Salt		
b. Sugar		
c. 10 per cent sugar		
d. Vinegar		
e. Oil		
f. Alcohol		

CANNING OF FOOD

A. *The effect of temperature on heat penetration in canned foods.*

1. Fit pint jars with 2-holed corks. Insert a thermometer in the center hole. Fill the jar with the substances listed and add water to within 1 in. of the top of the jar. Fit the cork firmly in the top of the jar and adjust the thermometer so that the bulb is in the center of the jar. Place the jars on a rack in hot water (not too hot to break the jars). Record the interior temperature of the food and the temperature

of the water. The water-bath should be maintained at the level of the food in the jar. Record the interior temperature of the food when the water begins to boil and at 15 min. intervals until it reaches a temperature in the upper 90°C.

a. Water.
b. Tomatoes cut in quarters.
c. Corn cut and scraped from the cob, or canned corn.
d. Ground meat.

2. Repeat 1 using three pressure cookers. Heat jars in one cooker for 30 min. at 15 lb. pressure, in the second for 45 min. at 15 lb. pressure; and the third for 60 min. at 15 lb. pressure. Allow the pressure to reach zero before opening the petcock. Remove jars and read the interior temperature immediately.

HEAT PENETRATION IN CANNED FOODS

Experiment	Initial temperature		Temperature when water boils (Food)	15 min.	30 min.	45 min.	60 min.	75 min.
	Water	Food						
1. Boiling water a. Water								
b. Tomatoes								
c. Corn								
d. Ground meat								

	Initial temperature of food	30 min.	45 min.	60 min.
2. Pressure cooker a. Water				
b. Tomatoes				
c. Corn				
d. Ground meat				

Prepare canned foods: Use boiling water bath for acid foods and pressure cooker for non-acid foods.

STANDARD PRODUCT

Appearance	Texture	Flavor

JELLY

To prepare juices for jelly select a mixture of slightly under ripe and ripe jelly fruit. Discard any damaged parts. Wash thoroughly. Discard the stems and blossom ends of apples, crab apples, and quinces. Cut the fruit into small uniform pieces, but do not remove the cores.

Wash berries quickly, lifting from the water. Drain and remove caps and stems of berries. Leave the stems on currants, the skins on grapes, quinces, and apples. Two pounds of prepared fruit will yield about one pint of juice.

1. To each pound of prepared hard fruit such as apples or crab apples add 1 c. of water and boil 20 to 25 min., stirring to prevent scorching. Crush soft berries and grapes to start flow of juice and boil 5 to 10 min. Pour the hot fruit into a jelly bag and let the fruit drip. When dripping has almost ceased, press the bag to obtain all the juice. Re-strain through a fresh bag wrung from hot water.

2. To make a second extraction, turn the pomace back into the kettle as soon as the first juice ceases dripping. Barely cover the pomace with water and simmer 15 to 20 minutes. Let drip as before. Taste the juice. If it does not have a tart flavor, add 1 tb. of strained lemon juice to each cup of the juice.

3. Prepare a juice from a sub-acid fruit and do not add lemon juice.

A. To determine the pectin content of fruit juice. Use juices 1, 2, and 3. Add 10 ml. of juice to 50 ml. of alcohol in a graduate. Invert the graduate slowly and turn back. Pour gently into a dish. If the pectin has precipitated in a mass there is enough pectin in the juice to make jelly.

PECTIN CONTENT OF FRUIT JUICES

	First extraction, tart juice	First extraction, sub-acid juice	Second extraction, tart juice
Pectin precipitate			

B. The effect of sugar, acid, and pectin on the formation of jelly.
   1. Use first extraction juice which is tart to taste or to which lemon juice has been added.
   2. Use a sub-acid juice.
   3. Use the second extraction from the same fruit as in 1, acidified if necessary.

   Add the amounts of sugar listed and boil the mixture to 106°C. Obtain the volume of the jelly by pouring into hot jelly glasses, the volume of which has been predetermined to a marked height. Set aside to jell, then compare for jelly formation.
   a. 1 c. juice and no sugar.
   b. 1 c. juice and ¼ c. sugar.
   c. 1 c. juice and ½ c. sugar.
   d. 1 c. juice and ¾ c. sugar.
   e. 1 c. juice and 1 c. sugar.
   f. 1 c. juice and 1¼ c. sugar.

PECTIN ACID AND SUGAR IN JELLY FORMATION

Experiment	Time of cooking	Volume in cups	Consistency	Color	Flavor
1. First extraction, tart juice a. No sugar					
b. ¼ c. sugar					
c. ½ c. sugar					
d. ¾ c. sugar					
e. 1 c. sugar					
f. 1¼ c. sugar					
2. First extraction, sub-acid juice a. No sugar					
b. ¼ c. sugar					
c. ½ c. sugar					
d. ¾ c. sugar					
e. 1 c. sugar					
f. 1¼ c. sugar					
3. Second extraction, tart juice a. No sugar					
b. ¼ c. sugar					
c. ½ c. sugar					
d. ¾ c. sugar					
e. 1 c. sugar					
f. 1¼ c. sugar					

C. Use a first extraction tart fruit juice, if possible from the extraction obtained for B 1.
   1. To 1 c. of juice add the amount of sugar found necessary to make a good jelly in Experiment B 1. Boil to the jelly test (sirup separates from the spoon into two distinct lines of drops, which sheet together).
   2. Test the juice with a jelmeter. Add the sugar required for 1 c. of juice and cook according to directions furnished with the jelmeter.
   3. Make jelly from 1 c. of same juice as in 1 using added pectin. Set aside to form a jelly, then compare.

METHODS OF MAKING JELLY

Experiment	Time of cooking	Volume	Consistency	Color	Flavor
1. Sheeting off test					
2. Jelmeter					
3. Added pectin					

Prepare jellies.

STANDARD PRODUCT

Appearance	Consistency	Flavor

1 What are the conditions which favor the growth of molds? Of bacteria? Of yeast?
2. List the methods of preservation which produce temporary preservation.
3. List the methods of preservation which produce permanent preservation.
4. Explain how salt acts as a preservative. Sugar.
5. Why can fruits be canned at the temperature of boiling water?
6. Why should fruits be canned at this temperature and not in a pressure cooker?
7. What is botulism? When may it occur?
8. Give the advantages and disadvantages of canning in glass. In tin.
9. List precautions to prevent loss of liquid from jars during processing in a pressure cooker.
10. What is meant by exhausting? Blanching?
11. Why are red fruits canned in enamel-lined cans? Corn?
12. What precautions must be used in open-kettle canning of fruits to prevent spoilage?
13. Should foods be left in a tin can after it is opened?
14. Why does cream-style corn require a longer processing period than whole-kernel corn?
15. Why is the boiling temperature used in preparing fruit juice for jelly?

16. Why should fruit not be too ripe when used for jelly making?
17. What substances are required to form fruit jelly?
18. Why is it important to limit the amount of water used to cook the fruit for making jelly juice?
19. List the conditions for obtaining the optimum color and flavor in jellies and preserves.
20. What are the differences among jellies, preserves, jams, marmalades, and conserves?
21. What causes syneresis in jellies?
22. What are the crystals sometimes found in grape jelly? How may they be prevented?
23. Why do jellies made with added pectin sometimes ferment?
24. Why does jelly sometimes fail to form?
25. How much sugar does an average homemade jelly contain?
26. Why are commercial jellies stiffer than the average homemade jellies?
27. Why is calcium oxide used in making watermelon preserves? Calcium chloride in canned tomatoes?
28. In making preserves why are soft fruits put directly into a heavy sirup, while hard fruits are put on to cook in a thin sirup?

REFERENCES

CHILD, A. M., and NILES, K. B. *Food Preparation Studies*. Second Edition. Chaps. X and XI.
LOWE, B. *Experimental Cookery*. Second Edition. Chap. V.
MACLEOD, A. L., and NASON, E. H. *Chemistry and Cookery*. Second Edition. Chap. XLIV.
MORGAN, A. F., and HALL, L. S. *Experimental Food Study*. Chaps. X and XII.
SWEETMAN, M. D. *Food Preparation*. Second Edition. Chap. VI.
U. S. D. A. Farmers' Bulletin 1800. *Home-made Jellies, Jams and Preserves.*
U. S. D. A. Farmers' Bulletin 1762. *Home Canning of Fruits, Vegetables and Meats.*

Weights of Food Materials Used in Food Preparation[1]

Food material	One cup	Miscellaneous measures
	grams	*grams*
Bread crumbs		
Dry		
Grated	88.0	—
Sifted	56.0	—
Fresh	46.0	—
Cereals		
Hominy		
Coarse	182.0	—
Grits	154.0	—
Oats, rolled (quick)	80.0	—
Rice, polished-whole	208.0	—
Wheat, whole	198.0	—
Cheese		
Cheddar, soft, sieved	112.0	—
Chocolate, grated	132.0	—
Cocoa, stirred	112.0	—
Coffee		
Drip-grind	84.0	—
Percolator	82.0	—
Pulverized	88.0	—
Eggs		
Whole, without shell	243.0*	48.0 per egg
White	243.0†	30.0 per white
Yolk	243.0‡	18.0 per yolk
Fats and oils		
Butter	224.0	—
Chicken fat, rendered	220.0	—
Compounds	200.0	—
Cream, 40 per cent fat	236.0	—
18 per cent fat	240.0	—
Hydrogenated fats	200.0	—
Lard	220.0	—
Margarines	224.0	—
Oils		—
Corn	220.0	—
Cottonseed	220.0	—
Olive	220.0	—
Peanut	220.0	—
Suet		
Chopped medium fine	120.0	—
Rendered	220.0	—
Flours and meals	*grams*	*grams*
Banana flour, sifted	118.0	—
Barley flour, sifted	226.0	—
Buckwheat flour, sifted	98.0	—
Corn flour, sifted	110.0	—
Corn meal		
Coarse, stirred	152.0	—
Fine, stirred	116.0	—
Cornstarch, stirred	128.0	3.0 per teaspoon
Gluten flour, sifted	142.0	—
Lentil flour, sifted	144.0	—
Lima bean flour, sifted	126.0	—
Potato starch, sifted	144.0	—
Rice flour, sifted	126.0	—
Rice polish, stirred	106.0	—
Rye flour		
Straight grade, sifted	80.0	—
Soybean flour, sifted	86.0	—
Wheat flour		
All-purpose, sifted	110.0	—
Hard (bread), sifted	112.0	—
Soft (cake), sifted	96.0	—
Soft (pastry) sifted	100.0	—
Whole wheat, stirred	120.0	—
Wheat germ, stirred	68.0	—
Fruit juices		
Lemon	246.0	—
Orange	248.0	—
Fruits, dried and preserved		
Apricots	150.0	—
Citron, diced	184.0	—
Currants	144.0	—
Dates, pitted		
Whole	188.0	—
Cut	178.0	—
Figs		
Whole	178.0	—
Cut	168.0	—
Ginger		
Crystallized, diced	170.0	—
Prunes		
Whole with seeds, No. 20–30	188.0	—

* 5 medium-sized eggs. † 8 medium-sized whites. ‡ 14 medium-sized yolks.

WEIGHTS OF FOOD MATERIALS USED IN FOOD PREPARATION (*Continued*)

Food material	One cup	Miscellaneous measures
	grams	*grams*
Fruits, dried and preserved—*Continued*		
Prunes—*Continued*		
Whole with seeds, No. 40–50	178.0	—
Whole with seeds, No. 60–70	172.0	—
Raisins		
Seeded	142.0	—
Seedless	164.0	—
Gelatin		
Granulated coarse	148.0	10.2 per tablespoon
Granulated fine	138.0	9.7 per tablespoon
Leavening agents		
Baking powder		
SAS-phosphate (K.C.) unstirred	—	3.7 per teaspoon
SAS-phosphate (K.C.) stirred	—	3.4 per teaspoon
SAS-phosphate (Calumet) unstirred	—	4.1 per teaspoon
SAS-phosphate (Calumet) stirred	—	3.8 per teaspoon
Tartrate (Royal) unstirred	—	4.1 per teaspoon
Tartrate (Royal) stirred	—	3.8 per teaspoon
Phosphate (Rumford) unstirred	—	4.5 per teaspoon
Phosphate (Rumford) stirred	—	4.3 per teaspoon
Baking soda, unstirred	—	4.5 per teaspoon
Baking soda, stirred	—	4.1 per teaspoon
Cream of tartar, unstirred	—	2.8 per teaspoon
Cream of tartar, stirred	—	2.6 per teaspoon
Milk		
Whole	244.0	—
Skimmed	246.0	—
Buttermilk	244.0	—
Condensed	306.0	—
Condensed with equal water	276.0	—
Evaporated, unsweetened	252.0	—
Evaporated with equal water	244.0	—
Skim milk powder, spray dried, sifted	112.0	—
Nuts		
Almonds		
Shelled, whole	142.0	—
Blanched, whole	152.0	—
Blanched, chopped	130.0	—
Cocoanut		
Prepared, shredded	62.0	—
Filberts		
Shelled, whole	134.0	—
Peanuts, medium		
Halves	144.0	—
Chopped	144.0	—
Pecans		
Halves	108.0	—
Chopped	118.0	—
Walnuts		
Persian "English"		
Halves	100.0	—
Chopped	122.0	—
Black		
Broken	130.0	—
Chopped	126.0	—
Pastes		
Macaroni		
2-inch pieces, broken	86.0	—
Noodles		
2-inch pieces, broken	58.0	—
Spaghetti		
2-inch pieces, broken	94.0	—

WEIGHTS OF FOOD MATERIALS USED IN FOOD PREPARATION (*Continued*)

Food material	One cup	Miscellaneous measures	Food material	One cup	Miscellaneous measures
	grams	*grams*		*grams*	*grams*
Pastes—*Continued*			Sugars and sirups—*Continued*		
Tapioca					
Granulated, minute, stirred	152.0	—	Tight pack	212.0	—
Pearl	164.0	—	Corn sirup	328.0	—
Seasonings			Honey	338.0	—
Salt, free running, medium fine	288.0	6.0 per teaspoon	Maple sirup	312.0	—
			Molasses, cane	328.0	—
Pepper	—	2.3 per teaspoon	Sorghum sirup	330.0	—
			Tea		
Sugars and sirups			Orange pekoe	72.0	—
White sugar, granulated	200.0	—	Pinhead gunpowder	104.0	—
XX sugar, powdered	190.0	—	Vegetables, dried		
XXXX confectioners sugar, powdered, stirred	128.0	—	Lima beans		
			Large	180.0	—
Brown sugar			Small	186.0	—
Light			Navy beans		
Loose pack	150.0	—	Large	184.0	—
Tight pack	228.0	—	Small	196.0	—
Dark			Peas, split	200.0	—
Loose pack	138.0	—	Soybeans	210.0	—

[1] Elizabeth F. Whiteman and Florance B. King. *Journal Home Economics*, 29:9, 641-645 (1937).

APPENDIX

Apparatus and Chemicals for 16 Students

Apparatus

Number	Items	Size
8	Balances, dietetic with movable dial	
2	Balances, trip	
2	Balance weights	1– to 500–gram set
4	Balance weights	1 lb.
4	Balance weights	1 oz.
48	Beakers	50 ml.
24	Beakers	250 ml.
24	Beakers	400 ml.
16	Beakers	600 ml.
16	Beaker tongs	
4	Bottles, dropping	30 ml.
16	Brushes, test tube	
8	Burners, Bunsen	
16	Clamps	$\frac{3}{8}$ by 5 in.
1 spool	Copper wire	22 gage
Bag	Corks	Assorted
1	Cork borer set	
8	Crucibles	
16	Culture dishes	120 x 15 mm.
2	Cylinders, graduate	500 ml.
16	Cylinders, graduate	100 ml.
8	Evaporating dishes	
16	Fermentation tubes	
2	Files, triangular	
8 boxes	Filter paper	110 mm.
16	Funnels	3–in. diameter
8	Funnel supports	5 x 8 in.
16	Glass stirring rods	5–mm. diameter
10 ft.	Glass tubing	6–mm. diameter
4 vials	Litmus paper (blue)	
4 vials	Litmus paper (red)	
4	Microscopes (student)	
16	Pipets	10 ml.
20 ft.	Rubber tubing	$\frac{1}{16}$–wall thickness $\frac{1}{4}$–in. diameter
96	Test tubes	20 by 150 mm.
8	Test tube supports	
16	Thermometers	– 20 to 150°C.
16	Thermometers	0 to 250°C.
8	Thermometers (meat)	
16	Ring stands	4 x 6 in. base
16	Rings for stands	3–in. diameter
16	Watch glasses	115–mm. diameter
16	Wire gauze squares	5 in.

Chemicals

Amount	Item
1 l.	Alcohol, ethyl, 95 per cent
4 oz.	Ammonium hydroxide
1 oz.	Calcium lactate
1 lb.	Carbon tetrachloride
1 oz.	Carmine
¼ oz.	Cupric acetate
2 oz.	Cupric sulfate
1 oz.	Hydrochloric acid, concentrated
¼ oz.	Iodine
1 oz.	Nitric acid, concentrated
1 oz.	Potassium acid tartrate
5 oz.	Potassium hydroxide
¼ oz.	Potassium iodide
8 oz.	Potassium sodium tartrate
1 oz.	Primary calcium phosphate
1 oz.	Sodium aluminum sulfate
1 oz.	Sodium carbonate
1 oz.	Tartaric acid

Starches

1 lb.	Arrowroot
1 lb.	Potato
4 oz.	Rice
4 oz.	Wheat

Sugars

4 oz.	Dextrose
4 oz.	Lactose
4 oz.	Levulose
4 oz.	Maltose
4 oz.	Sucrose

Solutions Used in Experiments

1. Cupric acetate: Dissolve 1 gm. cupric acetate in 50 ml. distilled water.
2. Fehling's solution is composed of two different solutions: cupric sulfate and alkaline tartrate solution.

   Solution A. Cupric sulfate: Dissolve 34.65 gm. cupric sulfate in distilled water and make up to 500 ml.

   Solution B. Alkaline tartrate: Dissolve 125 gm. potassium hydroxide and 173 gm. of potassium sodium tartrate in distilled water and make up to 500 ml.

   To prevent deterioration, these two solutions should be preserved separately in rubber-stoppered bottles and mixed in equal volumes when ready for use.
3. Iodine solution. Prepare a 2 per cent solution of potassium iodide and add enough alcoholic solution of iodine to color it deep yellow.

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